THE DEVELOPMENT AND INHIBITION OF PHYSICAL AGGRESSION IN EARLY CHILDHOOD: MEASUREMENT AND ASSOCIATIONS

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By

William Joseph Trainor

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ABSTRACT

Research suggests that the age at which humans are most physically aggressive is at the end of the second year of life. Typically, children will subsequently show a gradual decline in aggression during the third year of life and by the time they reach kindergarten, they will have learned to inhibit much of their aggressive tendencies (Arsenio, 2004a; Cote et al., 2007; Cote et al., 2006; Gauthier, 2003; Tremblay, 2000; Tremblay, 2001). Tremblay (2001) has discussed the possibility of a sensitive period (from approximately 24-36 months of age) for learning to restrain physical aggression. Two studies were conducted to assess the relative and cumulative associations between physically aggressive behaviour and both cognitive (executive function and vocabulary skills) and social-interactional (attachment and parenting styles) factors at different developmental periods. The first study involved parents and teachers reporting on a total of 436 children with a mean age of 42 months. The second study involved parents and teachers reporting on 85 children with a mean age of 34 months. Each of the studies were short-term longitudinal in nature involving a second wave of data collection to track the connections between changes in cognitive and/or social interactional functioning and changes in physically aggressive behavior over a one-year period. Results of this research suggest that aspects of executive function (inhibition and emotional control especially) appear to be particularly important in the prediction of physical aggression in this age period. Accordingly, support was obtained for Moffitt's (1993) theory emphasizing the role of cognitive processes in contributing to the development of early aggressive behavior. Implications for these findings are discussed with consideration of the plausibility of a sensitive period.

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Physical aggression is generally perceived to be more problematic than other forms of aggression. Perhaps not surprisingly, research shows that acts of physical aggression (as compared to other forms of aggression) are associated with more severe punishments by parents, teachers, and the justice system (Tremblay, 2000). This severity of intervention may well come as a function of society's beliefs about the potential ramifications and connotations of certain acts of physical aggression. Clearly, there is a need to understand and prevent the development of a propensity towards physical violence. The best manner of achieving this goal, however, has been debated for many years. What seems much less controversial is the shared belief that a propensity to aggress arises out of a developmental process, wherein extreme forms of physical aggression can be better understood through an examination of early developmental experiences and behaviours (Nagin & Tremblay, 1999; Tremblay, 1999; Tremblay, 2000).

For the better part of the 20th century, researchers neglected to consider the development of physical aggression during the preschool years. There are at least two major reasons why this occurred (Tremblay, 2000). The first reason relates to the belief that adult behaviours can be understood and studied independently of an individual's developmental history. As a result of this belief, much of the initial psychological research on aggression focused on adults, whose acts of physical aggression are thought to be more "serious" than those of preschoolers. Despite evidence to suggest that preschoolers are the most physically aggressive humans on earth (in terms of frequency, not the severity or consequences of their actions; Dodge, Coie, & Lynam, 2006; Tremblay, 2001), society views such behaviour as tolerable from this population. St. Augustine of Thagaste may have put it best when he said: "infants are harmless because of

physical weakness, not because of any innocence of mind" (Warner, 1963, p.24). However, as will be discussed in depth as part of the present dissertation, the impact of aggressive behaviour during the preschool years may not be completely harmless, as the early childhood period appears to serve as an important foundation for the development of physical aggression. The learning (with regard to the utility of physical aggression) that takes place during infancy and early childhood appears to have major ramifications for physically aggressive tendencies throughout the lifespan (Dodge et al., 2006; Patterson, DeBaryshe, & Ramsey, 1989; Tremblay, 2000; Tremblay, 2001).

The second reason why research on aggression involving a preschool population has lagged behind, concerns what Tremblay (2000) calls a "human adult biased view of child development" (p.134). This is part of a larger problem concerning the many different definitions that exist in the literature for "aggression" (Baron & Richardson, 1994; Tremblay, 2000). The human adult biased view of child development is the belief that what appear to be acts of aggression by infants do not involve an intention to do harm to another, and therefore, such behaviour does not qualify as aggression at all (Tremblay, 2000). According to this view, the very definition of aggression necessarily includes intent to harm. Many individuals both within and outside of the research community have endorsed this type of definition. This view implies that the origin of aggressive behaviour must exist following the necessary cognitive developments which would allow a child to empathize with others and have at least a rudimentary understanding of how their actions impact others. However, with this view it is relatively difficult to account for the apparent stability of physical aggression and precursors of aggressive behaviour (e.g., infant noncompliance, fussiness, and attention seeking), beginning very early in life (Shaw, Keenan & Vondra, 1994). This is not to say that levels of aggression do

not fluctuate throughout the lifespan, but rather, that compared to others within a group, individuals' relative use of physical aggression is highly consistent across time; the rank order among a group of individuals is highly stable, especially among males (Brame, Nagin, & Tremlay, 2001; Eron & Huesmann, 1984; Olweus, 1979; Olweus, 1984; Renken, Egeland, Marvinney, Mangelsdorf, & Sroufe, 1989; Shaw et al., 1994; Tremblay, 2000; Tremblay, 2001). In fact, Olweus (1979; 1984) has proclaimed the stability of aggression to be comparable to that of intelligence. This implies that the extent to which one employs physical aggression is likely founded, at least partially, early during childhood, perhaps prior to the cognitive developments necessary for such behaviour to involve the intention to harm. Moreover, measures designed to assess physical aggression typically do not assess the intentions of an individual's behaviour (Tremblay, 2001). This is likely because intent is not observable and perpetrators of aggressive acts often deny the intent to harm (Loeber & Hay, 1997). Accordingly, many researchers have begun to move to definitions of aggression that do not imply intentionality. Tremblay and Nagin (2005) have defined physical aggression as "the use of physical force against another person with an object (e.g., stick, rock, bullet) or without (e.g., slap, push, punch, kick, bite)" (p. 83). This is an appropriate definition to describe the type of behaviour that is of interest to the current program of research. The focus should be on objective behaviour, rather than the emotions, motives or attitudes of a child (Baron & Richardson, 1994). Although emotions, motives and attitudes may impact the occurrence of aggressive behaviour, none of these factors in and of themselves necessarily result in aggression (Baron & Richardson, 1994).

In the present dissertation, two studies were conducted to investigate the development of physically aggressive behaviour among preschool children, with regard to the connection that may exist to cognitive (executive functions and verbal abilities) and social interactional

(parenting styles and children's attachment to their caregiver) factors. The central research question was: Within the domains of cognitive and social interactional functioning, which factors (if any) are most strongly related to and predictive of physical aggression and changes in physical aggression at various ages during the preschool period of life? The implications of this research question may be linked to children's typically diminished reliance on physical aggression during the later preschool years, following the proposed sensitive period for learning to inhibit acts of physical aggression. A secondary research question also existed: Is there any preliminary evidence to support the notion of a sensitive period for learning to inhibit physically aggressive behaviour? This question was of secondary interest and was considered exploratory in light of the difficulties in concretely *establishing* sensitive periods in development (discussed below).

Although in the past, much research interest has surrounded the "origin" of aggressive behaviour, this is not the focus of the present research. Instead, the interest here is on understanding factors which contribute to the *inhibition* versus *maintenance* of physically aggressive behaviour, beyond what is thought to be a sensitive period (approximately 24-36 months of age) for learning to inhibit physical aggression (Tremblay, 2000; Tremblay, 2001). It is believed that a complete understanding of the initial development of aggressive capabilities is not entirely necessary to the study of the inhibition and maintenance of physical aggression. Regardless of whether humans are born with the capacity and tendency to utilize physical aggression (i.e., biological determinism), or whether this is a purely learned behaviour (i.e., social learning theory), it appears as though all typically developing children, universally, do eventually acquire the ability to aggress. The primary interest of this research then, is to improve our understanding of why the majority of children typically decrease their use of physical

aggression between 24 and 36 months of age. The corollary to this would be that if we understand the developmental course that characterizes the normative decrease in physical aggression, then we might be in a position to make inferences about the minority of children whose aggressive tendencies remain high beyond the sensitive period and to provide assistance to these children.

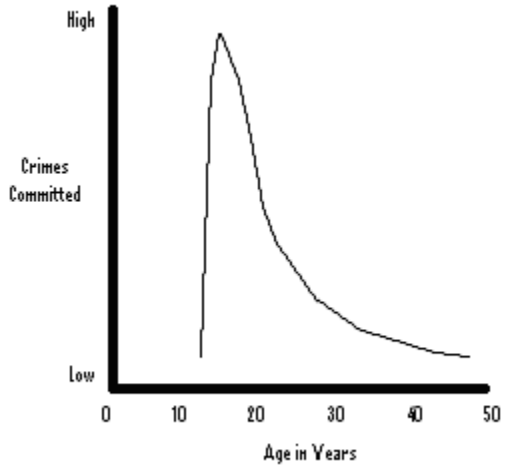
In order to clarify the components of this research program and its rationale, literature on the development of physical aggression is reviewed along with literature pertaining to the development of executive function, verbal skills, parenting styles, and attachment. Each of these factors is in turn considered with regard to their connection to the development and inhibition of physically aggressive behaviour among preschool children. Consideration is also given to the task of demonstrating empirical support for the supposition of a sensitive period for learning to inhibit physically aggressive behaviour.

Literature Review

The Evolution of Aggression Research

Developmental research on aggression has historically kept close ties with forensic criminology research. The "age-crime curve" (See Figure 1) depicts that youth generally show a greater propensity towards violent and criminal offending as they age, with this behaviour peaking at around 17 years of age and typically declining thereafter (Moffitt, 1993; Tremblay, 2000). Research on aggression, therefore, has focused heavily on adolescence, the period when aggressive behaviour apparently begins to have a more obviously detrimental impact on both society (i.e., the victims) and the individual perpetrators of aggressive acts (Moffitt, 1993; Tremblay, 2000). Moreover, recent studies have contradicted the theory that aggression increases steadily through childhood (e.g., DiGiunta, Pastorelli, Eisenberg, Gerbino, Castellani, Bombi,

Figure 1. Age-crime curve (Adapted from Moffitt, 1993).



2010). In fact, it seems that the greatest frequency of physically aggressive behaviour occurs at around the end of the second year of life (Tremblay, 2000; Tremblay, 2001). For a long time, however, it was believed that the age-crime curve was indicative of emerging aggressive tendencies during the adolescent years. Adolescence was viewed as being the origin of aggressive behaviour. Currently, it is still believed that some individuals do begin to exhibit aggressive tendencies at this time. However, recent literature has provided support for the existence of an early onset (i.e., prior to age 6) pattern of aggressive behaviour, which seems to be more problematic than late-onset aggression. Among physically aggressive adolescents and adults, the early-onset pattern of aggression appears to be more the norm than the exception (DiGiunta et al., 2010; Nagin & Tremblay, 2005; Brame et al., 2001; Tremblay, 2001). Also, those whose aggressive tendencies appear prior to school entry are less likely to cease engaging in antisocial behaviour in their early twenties (Brennan, Hall, Bor, Najman, & Williams, 2003). Nonetheless, only recently have researchers begun to shift their focus towards understanding the early development of physically aggressive behaviour, in an attempt to predict, and ultimately

prevent, later delinquency, particularly among those individuals who show an early-onset pattern of aggression.

Given the connection to research on adult and adolescent delinquency, the vast majority of the extant literature in this area has focused on the abstract concept of "aggression", rather than investigating specific subcomponents of aggressive behaviour (e.g., physical aggression, indirect aggression). However, this has proven to be problematic as different forms of aggression appear to have distinct determinants and developmental trajectories (Bandura, 1973; Tremblay, 2000). Sex differences are a good example of the need for specificity within the area of aggression research. Males appear to be more prone towards physical aggression, whereas females tend to be more inclined to exhibit indirect aggression (Eron & Huesmann, 1984; Split, Koomen, Thijs, Stoel, & Van der Leij, 2010; Tremblay, 2000).

Similarly, using factor analysis, Vaillancourt, Brendgen, Boivin and Tremblay (2003) reported a distinct difference between the constructs of indirect and physical aggression in a sample of three Canadian cohorts of children at different developmental time points (Time 1: 4-7 years of age; Time 2: 6-9 years of age; Time 3: 8-11 years of age). Two distinct non-overlapping groups of children emerged from this study, those who used physical aggression and those who used indirect aggression. Further, throughout the course of the study, both boys and girls demonstrated consistency with respect to the two types of aggression they employed most frequently. According to other research employing confirmatory factor analyses, physical aggression can also be considered statistically different from rule-breaking and social aggression (DeMarte, 2008), and from nonaggressive antisocial behaviour (Split et al., 2010).

As a result of the diverse manifestations of aggressive behaviour, it is important to strive for a high level of specificity, in order to avoid the problem of a definition discrepancy among

different researchers (Bandura, 1973; DiGiunta et al., 2010; Tremblay, 2000). Aggression can be categorized in several ways (e.g., active vs. passive, direct vs. indirect, hostile vs. instrumental, physical vs. verbal, reactive vs. proactive; Baron & Richardson, 1994; Marcus & Kramer, 2001). The current research project is concerned specifically with physical aggression.

A Developmental Psychopathology Framework for the Development of Physical Aggression

A developmental psychopathology model has been proposed as a way of thinking about antisocial and aggressive behaviour (Banaschewski, 2010; Gollan et al, 2005). Although physically aggressive behaviour alone does not constitute a distinct diagnostic category, "the influence of the developmental psychopathology perspective extends well beyond the consideration of diagnoses" (Drabick & Kendall, 2010, p. 272; Sroufe & Rutter, 1984; Rutter, 2010). A dimensional perspective of developmental psychopathology takes into account that aggressive behaviour occurs on a continuum (Banaschewski, 2010; Drabick & Kendall, 2010). The current research is concerned with the development of physical aggression in the general population. Accordingly, a dimensional developmental psychopathology framework lends itself well to the current investigation of physically aggressive behaviour, as it is a framework for explaining the developmental processes which lead to various outcomes.

Physical aggression among preschool children is typically exhibited on an occasional basis for most children, and on a frequent basis for only a small minority of individuals. For example, in a study of 17 month-olds, fewer than 5% of children were reported to show frequent physical aggression (Baillargeon, Normand, Seguin, Zoccolillo, Japel, Perusse, Wu, Boivin, & Tremblay, 2007). Aggression in general has been shown to be relatively stable from early childhood into adolescence and even into early adulthood. This is particularly true among a minority of individuals (about 4-7%) whose level of antisocial behaviour is extremely high

(Baron & Richardson, 1994; Brame, Nagin & Tremblay, 2001; DiGiunta et al., 2010; Moffitt, 1993; Nagin & Tremblay, 1999; Olweus, 1979; Tremblay, 2000; Tremblay, 2001; Vaillancourt et al., 2003). However, little research has been done to directly assess the stability of physical aggression from preschool to adolescence. Researchers like Arsenio (2004a) and Nagin and Tremblay (1999) have, however, shown that some individuals do follow a persistently high trajectory of physical aggression from kindergarten to late adolescence, whereby their rank order of physically aggressive behaviour is consistently high.

Furthermore, disruptive behaviour itself (including physical aggression as well as other forms of aggression, oppositional behaviour and hyperactivity) predicts physical aggression during adulthood (Tremblay, 2001). In general, the stability of antisocial behaviour (including disruptive behaviour as well as more serious legal and other conduct-related problems) is more variable within children who show normative levels of the behaviour (Moffitt, 1993). Overall, research suggests that "adults and adolescents who are physically aggressive were most certainly physically aggressive preschoolers" (Tremblay, 1999, p.60; Tremblay, 2000).

While physical aggression has been shown to be a stable characteristic across the lifespan, a developmental psychopathology perspective would suggest that this does not necessarily mean that a tendency towards physically aggressive behaviour during the preschool years directly causes physical aggression at later stages of life. This would likely be an oversimplification of the way in which this behaviour develops across time (Sroufe & Rutter, 1984). Other variables are likely involved in the development of physical aggression during the preschool years and beyond. Development is hierarchical; more complex abilities at later stages of development depend on the acquisition of prerequisite skills at earlier developmental periods (Sroufe & Rutter, 1984). Accordingly, physical aggression during the preschool years may be an

influential factor in the development of self, cognitive skills and/or social skills, which may in turn serve to contribute to the manifestation or inhibition of antisocial behaviour and physical aggression during later points in development. Likewise, high levels of physical aggression during early childhood may also alter environmental factors, such as family dynamics, or the quality of family or peer relations; these factors may in turn mediate or moderate development in a way that contributes to later physically aggressive behaviour. A complete developmental model of physical aggression would include identification of factors which mediate or modify the course in which this behaviour develops (Sroufe & Rutter, 1984).

A number of previous studies have been done to examine possible factors related to aggressive behaviour. One such study involving children in daycare found that according to ratings taken from professional caregivers, negative interactions with peers (e.g., hitting, kicking, pulling, pushing, taking away objects, and verbal or non-verbal sounds or protest) at 15 months of age were predictive of aggressive and disruptive behaviours at 23 months (Deynoot-Shaub, & Riksen-Walraven, 2005). Similarly, in a sample of preschool-aged girls, Rubin, Burgess, Dwyer, and Hastings (2003) found that conflict-aggressive interactions at age 2 years were related to later externalizing problems (e.g., aggression and delinquency). Further, emotion-behavioural undercontrol (e.g., any evidence of angry affect, including frowning and screaming) at age 2 was found to be a significant predictor of age 4 externalizing difficulties. Together, temperament, maternal behaviour/parental styles, and the frequency of initiated conflictual and aggressive interactions at age 2, were found to be significant precursors to the development of externalizing behaviour at age 4 (Rubin et al., 2003).

In a study by Trainor, Schactman, Hatton, Tourigny, and McKim (2005) data were obtained from 168 primary caregivers of children who were 18 and 42 months of age.

Distractibility/hyperactivity and difficult temperament emerged as uniquely significant predictors of high levels of aggression, across the two time periods.

Consistent with a developmental psychopathology framework, recent statistical advances in group-based modelling (Nagin, 1999) have made it possible to study different pathways or trajectories of aggression, distinguishing for example, children who are persistently aggressive from children who show high levels of aggression that subsequently decline or children who are consistently low in aggressive behaviour. Most research in this area has differentiated between four trajectories of physical aggression among children: persistently high, high-declining, moderate-declining, and persistently low levels of physical aggression across time periods (e.g., DiGiunta et al., 2010; Nagin & Tremblay, 2001; Shaw, Gilliom, Ingoldsby, & Nagin, 2003). Some research has suggested a fifth trajectory as well, however, consisting of children reported to show extremely low, almost non-existent levels of physical aggression (Arsenio, 2004a; Maldonado-Molina, Reingle, Tobler, Jennings, & Komro, 2010).

To date, only a limited number of studies have attempted to pinpoint factors that relate to aggression trajectory (pathway) membership. At this time, relatively little is known about what may contribute to the development of a chronically high pattern of aggressive behaviour. Existing findings regarding trajectory membership suggest that boys (as compared to girls) are more likely to maintain a stable pattern of physically aggressive behaviour (Arsenio, 2004a; Baron & Richardson, 1994; Broidy et al., 2003; Cote et al., 2007; Cote et al., 2006; Kyung-Hye, Baillargeon, Vermunt, Wu, & Tremblay, 2007; Maughn, Pickles, Rowe, Costello, & Angold, 2000). Moreover, persistently aggressive boys have been found to display high levels of fearlessness when aggression is defined by both physical acts and non-compliance (Shaw, Gilliom, Ingoldsby, & Nagin, 2003).

Arsenio's (2004a) work shows that young children who are highly physically aggressive early on (i.e., by age 2) and continue to show these behavioural tendencies as they enter school are more likely to experience social and academic difficulties in middle childhood (grade 3). In Arsenio's research, five trajectories of physical aggression were delineated, including: very low across measurements, low, initially moderate declining over time, consistently moderate, and consistently high physical aggression across measurements.

A greater persistence in aggression can also be predicted by family adversity or risk in the form of poverty (Cote et al., 2006; Maughn et al., 2000), poor supervision of the child, parental criminality, large families (Maughn et al., 2000), maternal depression, parental rejection (Shaw et al., 2003), less sensitive parenting, and lower maternal education (Arsenio, 2004a; Cote et al., 2006). Further, the likelihood of exhibiting physical aggression is exacerbated by a homecare arrangement (rather than daycare) among children who experience multiple family risk factors (Borge, Rutter, Cote, & Tremblay, 2003). With regard to the development and inhibition of physical aggression, the significance of the relationship between child and caregiver is perhaps heightened within at-risk families (Shaw, Keenan & Vondra, 1994).

The focus of the developmental psychopathology model is on the interaction of biological, psychological and social factors in the expression of both typical and atypical development (Cicchetti, 2006). Central to the field of developmental psychopathology are the concepts of equifinality (that similar outcomes can be derived from different pathways) and multifinality (that common pathways can lead to different outcomes; Cicchetti, 2006; Cicchetti & Rogosch, 1996; Gollan, Lee, & Coccaro, 2005). The current research is concerned with the processes that contribute to different levels of physically aggressive behaviour; however, consistent with the concept of multifinality, exposure to a risk factor does not necessarily mean

that a child will become aggressive or develop a sustained pattern of physically aggressive behaviour (Arsenio, 2004a; Cote et al., 2006; Maughn et al., 2000; Rubin et al., 2003; Shaw, Keenan & Vondra, 1994; Trainor et al., 2005). Similarly, equifinality is relevant to the study of physical aggression as well, as there is no single course of development which leads to the expression of high or low levels of this behaviour for all children (Reebye, 2005). It is presumed that different children aggress (or do not aggress) for different reasons. The current research does not seek to delineate pathways leading to atypically high levels of physical aggression; rather, the current research seeks to compare the relative contributions of several known risk factors in the prediction of physical aggression in general.

While a developmental psychopathology model provides an overarching framework for understanding antisocial or aggressive behaviour, it is not sufficient. Further specification is required to identify risk and resilience factors in order for a model of developmental psychopathology to delineate "how and when" these factors may influence the development of physical aggression (Gollan et al., 2005, p. 1157). To this end, a number of "variable-oriented" (Cicchetti & Rogosch, 1996, p. 598) theories, which can be integrated to fit within the larger developmental psychopathology model, were considered within the present research in order to identify and examine possible risk factors for the development of physically aggressive behaviour.

Theoretical Perspectives on Aggression in the Literature

Baron and Richardson (1994) assert that most theoretical perspectives on aggression can be organized into four categories. Indeed, throughout the literature, each theory of aggressive behaviour can be viewed to place emphasis on at least one or two of the following: "(1) innate urges or dispositions; (2) externally elicited drives; (3) cognitive emotional processes; (4) present

social conditions combined with previous learning" (p. 13). The current research focuses most on Baron and Richardson's (1994) third and fourth categories, however.

Modern interpretations of much of the aggression research can generally be organized into two theoretical frameworks: (1) control theory and (2) social-interactionism (Lilly, Cullen, & Ball, 2007; Patterson et al., 1989; Wallace, 2010). Both primarily emphasize Baron and Richardson's (1994) fourth explanation for aggression, which hinges on social conditions and behaviouristic learning principles.

Control theory asserts that aggression is a component of antisocial behaviour, which can be explained by the social bonds that an individual develops. These bonds include "attachment to parents, commitment to conventional activities, and belief in the conventional rules of society" (Foshee & Bauman, 1992, p. 66). According to the tenets of control theory, parental behaviours are traditionally thought to be irrelevant to whether or not children engage in deviant behaviour (Foshee & Bauman, 1992). Poor parent-child bonding is believed to directly result in a failure to identify with appropriate parental and societal values (Foshee & Bauman, 1992; Lilly, et al., 2007; Patterson et al., 1989; Wallace, 2010). This, in turn, results in non-conformity and increases the likelihood of aggressive behaviour, as a weak attachment bond is thought to leave an individual susceptible to the influence of deviant role models (Foshee & Bauman, 1992; Wallace, 2010). Accordingly, control theory contends that there is a negative relationship between attachment to one's caregiver and deviant behaviours such as physical aggression (Foshee & Bauman, 1992; Lilly et al., 2007; Patterson et al., 1989). Although research has generally supported a negative relationship between attachment security and aggression (e.g., Baron & Richardson, 1994; Lyons-Ruth, 1996 Marcus & Kramer, 2001; Moss, Smolla, Cyr, Dubois-Comtois, Mazzarello, & Berthiaume, 2006; Renken, Egeland, Marvinney, Mangelsdorf,

& Sroufe, 1989), this has not necessarily been found to be the only factor contributing to childhood deviance (Foshee & Bauman, 1992). With regard to physical aggression specifically, many researchers contend that parenting behaviours are also relevant (e.g., Brennan, et al., 2003; Foshee & Bauman, 1992; Patterson, et al., 1989). Control theory pertains to the current research in that consideration was given to both attachment and parenting styles.

According to a social-interactional perspective, the actual behaviours of caregivers and others are thought to be particularly relevant to the development of aggressive behaviour (Foshee & Bauman, 1992; Patterson, et al., 1989). Proponents of this theory contend that childhood aggression is a function of environmental influence, as family members and others, directly train the child to behave in an aggressive manner early in life (Patterson, et al., 1989). This can occur through "poor parental monitoring of child activities, disruptive family transitions (e.g., divorce), and inconsistent parental discipline" (Brennan, et al., 2003, p. 309). This theoretical perspective on social interaction offered by Patterson and colleagues' (1989) follows from empirical evidence supporting a connection between family management practices and various forms of aggression (Baron & Richardson, 1994; Eron & Huesmann, 1984).

Ultimately, under a social-interactionist model, aggressive children have experienced some form of reinforcement for their aggressive behaviour while concurrently receiving a lack of prosocial skills training (e.g., the utilization of verbal conflict solution strategies; Eron & Huesmann, 1984; Patterson et al., 1989). In particular, physical aggression is thought to emerge within an aversive family system, whereby physical acts of aggression may be a functional means of escape from intrusive family members or from aversive parental discipline (Brennan et al., 2003; Patterson et al., 1989). Over time, the intensity of aggressive behaviours escalates, as caregivers react to the child's behaviour and the child reacts to his/her environment (Patterson et

al., 1989). Accordingly, both the individual and his or her environment are viewed as important determinants of behaviour.

The process of reinforcement for physical aggression may come to be maintained once the child begins to interact more with peers. Empirical research has shown that physically aggressive children are often rejected by their more typical, less aggressive peers (Baron & Richardson, 1994; Campbell et al., 2010; Marcus & Kramer, 2001; McDougall et al., 2001; Patterson et al., 1989) and may subsequently become involved with a "deviant peer group" (Dishion & Patterson, 2006; Patterson et al., 1989, pp. 330-331). As a result, a child may avoid developing many of the age-appropriate prosocial skills (e.g., using words to communicate rather than aggressing physically) that receive less reinforcement within the deviant peer group (Patterson et al., 1989). Instead, these peers reinforce antisocial behaviour, such as physical aggression, and concurrently "facilitates the transition from simple coercive behaviour to actual delinquency" and adult offending (Brennan et al., 2003, p. 310; Dishion & Patterson, 2006). Thus, from a social-interactional view, it makes sense that delinquency during later childhood and even adulthood can be predicted by early childhood experiences and acts of physical aggression (Olweus, 1979; Brame, Nagin & Tremlay, 2001; Dishion & Patterson, 2006; Patterson et al., 1989, Tremblay, 2000).

To date, there has been much interest in delineating the sociodemographic factors, family influences and parent-child relations that may account for a sustained pattern of physical aggression. This stems from the tradition of looking towards parenting practices to explain a child's behaviour. Recently, however, there has been a shift towards also examining links between aspects of cognitive functioning and physical aggression in order to better explain how

the child him/herself fits into an overall understanding of the development of physically aggressive behaviour tendencies (e.g., Moffitt, 1993; Brennan et al., 2003).

Moffitt (1993) devised another theoretical perspective on aggression that complemented Patterson and colleagues' (1989) social-interactional theory. Moffitt (1993) emphasized the role of "biological" or cognitive processes in contributing to the development of an early-onset pattern of aggressive behaviour. Thus, this perspective shifted the focus for explaining aggression to Baron and Richardson's (1994) third category of aggression theories (cognitive and emotional processes). Moffitt (1993) contended that congenital neuropsychological deficits negatively affect a child's temperament, executive function and language abilities. Subsequently, each of these factors is thought to contribute to the development of antisocial behavioural tendencies (Brennan et al., 2003). Moffitt's assertions have since been supported by a number of empirical studies (e.g., Brennan et al., 2003). Moffitt (1993) also acknowledged, however, that the biological/cognitive risk factors for aggression also tend to coincide with the important social disruptions that had been previously highlighted by Patterson and colleagues (1989).

Appropriately, Brennan and colleagues (2003) subsequently addressed the utility of integrating the perspectives of Moffitt (1993) and Patterson and colleagues (1989). Brennan et al. (2003) found empirical support for a cumulative risk factor model for the development of a persistent pattern of aggressive behaviour, which incorporated both social (e.g., mother's harsh discipline style, poor parental monitoring, youth perception of maternal hostility, etc.) and biological/cognitive (e.g., infant temperament, executive functioning, vocabulary skills, etc.) predictor variables. The most likely children to exhibit "early-onset persistent aggression" (p. 319) were said to be individuals with a high number of both biological and social risk factors

(Brennan et al., 2003). Overall, Brennan and colleagues (2003) suggested that "early social risks interact with later biological risks to predict persistent aggression" (p. 320).

Despite the significance of their research, Brennan et al. (2003) left several questions to be answered surrounding the development of aggressive behaviour among children. Specifically, the primary focus of their research did not allow for a comprehensive analysis of preschool children's development in terms of learning to inhibit acts of physical aggression. This is noteworthy given the suggestion that a sensitive period may potentially exist somewhere during the preschool years (24-36 months according to Tremblay, 2000). Rather, Brennan and colleagues' (2003) research involved data collection at age 6 months, 5 years, 14 years and 15 years of age. Moreover, Brennan and colleagues (2003) assessed a high-risk sample of individuals, in order to gauge the developmental processes that contribute to the development of a chronically high pattern of delinquent and aggressive behaviour. Inferences were not made about children who show the normative pattern of high initial aggressive behaviour, which eventually desists (Brennan et al., 2003). Brennan et al. (2003) also did not specifically address the development of physically aggressive behaviour, but rather, examined the broader concept of "aggression" (which includes physical aggression, as well as other aggressive concerns such as temper tantrums, and apparent frustration). Accordingly, research remains to be done in order to address the gaps in the literature that follow from the research of Patterson et al. (1989), Moffitt (1993) and Brennan et al. (2003), and have yet to be resolved.

In the present program of research, both parenting variables and child variables were examined in an attempt to explore some of the potential mechanisms behind physical aggression and the normative inhibition of physically aggressive behaviour when children are between 24 and 36 months of age. Consequently, it was of interest whether the results of the present research

would provide support for Brennan and colleagues' (2003) integrated theoretical perspective on aggression. In addition, however, the present research studies employed the strategy of looking at both relative (i.e., strongest predictor) and cumulative (i.e., combined) predictive ability of factors that relate to physical aggression with the goal of examining which category of variables (i.e., cognitive and/or social-interactional) would emerge as most relevant to the development of physically aggressive behaviour, and similarly which theory (or combination of theories) garnered the strongest empirical support. In order to properly address this issue, it was necessary to examine specific variables within both the cognitive and social-interactional domains that have been consistently linked to physical aggression in childhood. The inclusion of both cognitive and social-interactional variables fits well within a developmental psychopathology framework or model wherein the integration of biological, psychological and social factors is routinely sought in the explanation of atypical development (Cicchetti, 2006, Rutter, 2010).

Cognitive Variables

Receptive and expressive vocabulary. A distinction can be made between expressive and receptive vocabulary (Dionne, Tremblay, Boivin, Laplante & Parusse, 2003; Fernald, Perfors & Marchman, 2006; Ouellette, 2006) such that expressive vocabulary refers to communicative production, whereas receptive vocabulary encompasses one's understanding of others' communication (Dionne, et al., 2003; Fernald et al., 2006). Despite some level of exclusivity between these language domains, research has found positive correlations between children's expressive and receptive vocabulary knowledge (e.g., Fernald et al., 2006; Ouellette, 2006; Spere, Evans, Hendry, & Mansell, 2009). The current research is among a very limited number of studies to examine both expressive and receptive language skills in relation to physical aggression.

Biemiller and Slonim (2001) have posited that vocabulary acquisition occurs sequentially, in a predictable manner. Receptive vocabulary appears to develop prior to expressive vocabulary (Fernald et al., 2006). Children appear to show signs of oral comprehension as early as 8 months of age, whereas the first indication of expressive vocabulary typically appears closer to 12 months of age (Fernald et al., 2006; Ganger & Brent, 2004). Subsequently, once a child has developed a repertoire of approximately 50 words, their vocabulary growth steadily increases, until sometime during the latter half of the second year of life (usually around 18-20 months) when a dramatic developmental change typically occurs. At this point vocabulary growth increases at a significantly expedited rate (Courage & Howe, 2002; Ganger & Brent, 2004). With the onset of this "vocabulary spurt", children's oral vocabularies (both expressive and receptive) often expand by 10 to 20 words per week (Ganger & Brent, 2004).

Children's vocabularies continue to increase through childhood (e.g., Biemiller & Slonim, 2001; Courage & Howe, 2002; Fernald et al., 2006; Ganger & Brent, 2004; Tardif, 1996). By 24 months of age children have acquired, on average, 300 words (Ganger & Brent, 2004). By the time they receive reading instruction in school, most children in North America have an oral vocabulary between 5,000 and 7,000 words (August, Carlo, Dressler, & Snow, 2005). Nonetheless, not all children's vocabularies progress at the same rate. There appear to be large discrepancies in the oral vocabularies of different children, even prior to any formal pedagogical instruction (Fernald, et al., 2006; Ganger & Brent, 2004). The preliterate variance in expressive and receptive vocabularies has been associated with individual, social, socio-economic and linguistic factors (e.g., Biemiller & Slonim, 2001; Wertsch & Tulviste, 1992).

Overall, between 3 to 15 percent of individuals in the general population show some form of oral language delay (e.g., Dionne, et al., 2003).

Language ability and aggression. Previous research has suggested that language skills generally predict aggression in children (e.g., Dionne et al., 2003; Estrem, 2005). Dionne, and colleagues (2003) found that physical aggression among 19-month-old twins was negatively correlated with expressive vocabulary. Moreover, among a sample of 100 preschool children, Estrem (2005) found a significant association between receptive vocabulary and physical aggression. Dionne and colleagues suggested that an early language delay may predispose children to be more physically aggressive and subsequently, these children are slow to decrease in their aggressive tendencies at the developmentally appropriate age. Some time ago, Moffitt (1993) speculated that children who exhibit persistently high trajectories of aggression likely have neurological deficits that compromise their verbal and executive functioning. Hughes and Ensor (2006) found that both verbal ability and executive function (which were themselves interrelated) were associated with behaviour problems in a sample of two-year-old children. No assessment of the relative and cumulative impacts of executive function and verbal skills was undertaken, however, suggesting that the present research makes a novel contribution in this regard.

Also of relevance to the current research, vocabulary knowledge in general, has been linked, both directly and indirectly, to a number of important social, behavioural and cognitive concerns (e.g, Bonica, Arnold, Fisher, & Zeljo, 2003; Dionne, et al., 2003; Harris, 2006; Hughes & Ensor, 2006; Ouellette, 2006). In a study of 127 children aged 24-36 months of age, Hughes and Ensor (2006) found that verbal ability (i.e., a composite of expressive and receptive vocabulary skills) was negatively associated with behaviour problems (i.e., observer ratings of

difficulties regulating emotions and maternal reports of attention deficit hyperactivity symptoms). Although Hughes and Ensor (2006) did not consider children's expressive or receptive vocabularies separately in relation to aggressive behaviour, their results nevertheless suggest that on a combined basis, deficits in verbal ability are connected to disruptive behavioural tendencies among young children. In the present research, expressive and receptive vocabulary scores were treated as separate constructs to examine whether they were differentially connected to physical aggression.

In a series of studies, Moffitt (e.g., 1990; 1993) and colleagues (e.g., Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt & Silva, 1988a; Moffitt & Silva, 1988b) found links between poor verbal skills and general antisocial behaviour. Sampling from a large unselected birth cohort of both boys and girls, these researchers assessed Verbal IQ and Verbal Fluency (measured via a card-sort technique) in relation to self-reported delinquency, when participants were adolescents. Overall, poor verbal skills were found to be predictive of higher delinquency scores.

Dionne, Tremblay, Boivin, Laplant and Parusse (2003) examined 562 19-month-old twins, in order to gauge the relationship between physical aggression and expressive vocabulary. It was established that parent-reported levels of physical aggression were negatively correlated with expressive vocabulary (Dionne, et al., 2003). Dionne and colleagues (2003) consequently hypothesized that an early language delay may predispose children to be more physically aggressive. However, this study involved only one time period and, thus, could not verify whether deficits in vocabulary preceded behaviour problems or were simply a concurrent correlate. Accordingly, the authors recommended that longitudinal studies, involving several aspects of children's language skills, be employed in order to test their hypothesis (Dionne et al.,

2003). In the present research, a short-term longitudinal design (over one year) was employed to examine the connections between changes in receptive and expressive language skills and changes in physically aggressive behaviour.

Language deficits alone, however, are likely insufficient to account for the emergence or persistence of an aggressive pattern of behaviour. Indeed, Dionne and colleagues (2003) have speculated that language delays and aggression may have a shared etiology. Moffitt (1993), for example, suggested that children who exhibit persistently high trajectories of aggression likely have neurological deficits that compromise executive function *and* verbal skills. Executive function deficits have since been implicated as a potential source of childhood aggression (Dodge et al., 2006; Seguin & Zelazo, 2005).

Executive function. According to Liebermann, Giesbrecht and Muller (2007) executive function is "an umbrella term that generally refers to the mental operations involved in the conscious control of thoughts and actions" (p. 512). MacAuley, Chen, Goos, Schachar and Crosbie (2010) have further stated that executive abilities "facilitate purposeful, goal-oriented behaviour" (p. 495). Executive function refers to higher-order cognitive processes including self-regulation, working memory, delay of gratification, the ability to shift problem solving strategies when necessary, planning, attention allocation, initiating behaviour, impulse control and cognitive inhibition (Bjorklund, 2005; Bonli, 2005; Carlson, Mandell, & Williams, 2004; Davidson, Amso, Anderson, & Diamond, 2006; Ellis, Weiss, & Lochman, 2009; Epsy, Kaufmann, Diamond, 2006; Glisky, & McDiarmid, 2001; Gioia, Epsy & Isquith, 2003; Gioia, Isquith, Kenworthy, & Barton, 2002; Hughes & Ensor, 2006; Tamminga, 2000). There is currently no universally accepted theory of executive function, however, and a debate exists in the literature regarding the definition and boundaries of this construct (Gioia et al., 2002; Mabry,

2005; Rennie, Bull, & Diamond, 2004). At this time there appear to be multiple ways of conceptualizing executive function. Some definitions of this construct have been "so broad as to span the whole range of human cognition" (Zelazo et al., 1999, p. 218). Studies have demonstrated however, that executive function can be differentiated from general intelligence. Blair and Razza (2007) conducted a longitudinal study of 141 children from low-income families. Inhibitory control and attention-shifting (two domains of executive function) were found to correlate moderately with measures of general intelligence during preschool (mean age = 5 years, 1 month). However, when general intelligence scores were controlled for, these executive function scales each accounted for a significant proportion of variance in emerging academic skills (math and literacy) as measured one year later when children were in kindergarten (mean age = 6 years, 2 months). Moreover, Danielsson, Henry, Ronnberg, and Nilsson (2010) conducted a study comparing the executive skills of 46 adults with a diagnosed Intellectual Disability to those of a control sample (matched for chronological age, gender and level of education) of 92 adults without an Intellectual Disability. Relative to the control group, those with an Intellectual Disability demonstrated deficits in word recall and verbal fluency tasks, which both required a high level of verbal skills. No differences were found between the two groups on a non-verbal measure of planning and inhibition, however, suggesting that a distinction exists between the constructs of intelligence and these aspects of executive function.

The degree of separation between executive function and language ability is of particular relevance to the current research. Small to moderate relations typically exist between measures of executive function and verbal ability during the preschool years (e.g., Blair & Razza, 2007; Carlson, et al., 2004; see Muller et al., 2009 for a review). Following from Vygotsky's (1962) premise that language serves a self-regulatory function, language ability and executive function

are often viewed as being inherently intertwined. While language and executive function are theoretically different constructs, it has been suggested that developments in linguistic skills (particularly speech) may facilitate improvements in other cognitive and executive domains (Bonli, 2005; Hughes & Graham, 2002; Liebermann, 2010; Muller, Jacques, Brocki, & Zelazo, 2009; Sarsour, Sheridan, Jutte, Nuru-Jeter, Hinshaw, & Boyce, 2011). Specifically, as language skills develop, children become better able to employ linguistic reasoning to direct their own behavior; during the preschool years children can often be seen "thinking out loud" using verbal commands or self-instructions, while this typically becomes more private and internalized during the elementary school years (Liebermann, 2010; Muller et al., 2009; Sarsour et al., 2011). Language is thought to help children regulate their thoughts emotions and behaviour, and exert control over their environment by allowing them to plan and organize, "rendering them capable of voluntary, purposeful behaviour" (Muller et al., 2009, p. 55).

Research by Vallotton and Ayoub (2010) suggests that vocabulary predicted self-regulation skills even after controlling for cognitive ability (as measured by the Mental Development Index of the Bayley Scales of Infant Development) in children 14-36 months of age. This suggests that general intelligence does not adequately account for all of the variance in verbal and executive skills. The authors note that this finding provides empirical support for Vygotsky's (1962) notion that verbal skills may facilitate the development of self-regulation (Vallotton & Ayoub, 2010). It is important to keep in mind that this research was not experimental, therefore causal relations could not be drawn between language and regulatory skills, however, this research does highlight the apparent connection between these two areas of development during the preschool years. The precise nature of the relationship between language and executive function is difficult to elucidate, in part because the inherent interconnection

between these two constructs is such that it is challenging to measure either language or executive function in complete isolation, separate from the other (Hughes & Graham, 2002). Accordingly, measurements of executive function are often confounded to some degree by linguistic abilities, and vice versa (Hughes & Graham, 2002). In all, executive skills appear to be distinct from other cognitive abilities, such as language skills, however, the precise boundaries between executive function and other cognitive constructs are not especially clear, and some degree of overlap between these constructs likely does exist.

The measurement of executive function in general is complex and challenging. Performance-based neuropsychological measures (e.g., the Stroop test, Tower of Hanoi, Wisconsin Card Sorting Test) have notable limitations. These measures have been said to lack ecological validity, suggesting a limitation in the extent to which these measures generalize to "real-world" situations (Burgess, Alderman, Evans, Emslie, & Wilson, 1998; Gioia et al., 2002, Gioia, Isquith, Guy & Kentworthy, 2000). In fact, performance-based neuropsychological measures may not be sensitive to executive dysfunction; these tasks inherently provide a high level of structure, mitigating the need for executive skills like strategic planning and goal-oriented behaviour, thus potentially optimizing performance (Gioia et al., 2002). Moreover, although each performance-based task is designed to assess specific components of executive function, it is difficult to identify exactly what is being measured by each of these instruments, as they are limited by "multiple confounds" (Gioia et al., 2002, p.122; Kirkham & Diamond, 2003). Therefore, "the reasons for poor performance on a purported measure of executive function may not be clear" (Gioia et al., 2002, p.122). Similarly, there are limited numbers of measures designed to assess a wide range of executive skills (Gioia et al., 2002). Therefore comprehensive assessments of executive function have often been forced to employ several different tests,

normed with varying populations and with different psychometric properties, meaning that administration procedures are not altogether standardized (Davidson et al., 2006; Gioia et al., 2002).

One particularly challenging issue for the present research is the debate on whether executive function exists as a unitary construct during the preschool years (Wiebe, Sheffield, Nelson, Clark, Chevalier, & Epsy, 2011) or manifests in multiple (observable) executive domains. Wiebe and colleagues (2011) have argued that the differentiation of executive function skills comes only later in development. Most contemporary definitions of executive function have placed emphasis on there being multiple components within the construct of executive function (e.g., Burgess, et al., 1998; Davidson, et al., 2006; Diamond, 2009; Diamond, Carlson & Beck, 2005; Gioia et al., 2003; Hughes & Graham, 2002; Zelazo et al., 1997). This is largely due to research employing factor analyses, which usually suggests the existence of 2-5 distinct executive domains (see Royall et al., 2002 for a review), typically including the abilities to "inhibit competing actions or stimuli" (Gioia et al., 2002, p. 122), initiate behaviour, plan, organize and solve problems, shift problem solving strategies when necessary, monitor and regulate one's behaviour, as well as working memory skills (Gioia et al., 2002). In the development of the Behaviour Rating Inventory of Executive Functioning (BRIEF) for children 5-18 years of age, Gioia, Isquith, Guy and Kenworthy (2000) had 1419 parents and 720 teachers rate 86-items pertaining to children's executive skills. Results of a principal components analysis identified eight subdomains and two composites (Inhibit, Shift and Emotional Control made up the Behavioural Regulation Index; Initiate, Working Memory, Plan/Organize, Organization of Materials and Monitor made up the Metacognition Index).

Gioia, Epsy and Isquith (2003) subsequently adapted their measure of executive function for use with preschool children (utilized within the present two studies). Using principal factor analyses, a study involving 460 parents and 302 teachers suggested that five executive function subdomains could be accurately measured for children aged 2-5 years including Inhibit, Shift, Emotional Control, Working Memory and Plan/Organize. Like most instruments designed to measure executive function, the BRIEF and BRIEF-P (Behaviour Rating Inventory of Executive Functioning – Preschool Version) are largely atheoretical. This is a result of the lack of theoretical agreement surrounding the construct, its definition and composition (Mabry, 2005; Gioia et al., 2000; Gioia et al., 2003). It is important to note, however, that counter to the "unitary construct" supposition (Wiebe et al., 2011), Gioia et al. (2003) have been successful in dissociating behavioural manifestations of executive function in preschool age children.

Different manifestations of executive function at different stages of development may be explained by neurological maturation. Research has linked executive skills to frontal lobe and prefrontal cortex activity (Alvarez & Emory, 2006; Bjorklund, 2005; Garon, Bryson, & Smith, 2008; Gioia, Epsy & Isquith, 2003; Mabry, 2005; Muller, Jacques, Brocki, & Zelazo, 2009; Royall, Lauterbach, Cummings, Reeve, Rummans, Kaufer, LaFrance, & Coffey, 2002; Tamminga, 2000; Zelazo, Carter, Reznick & Frye, 1997). The prefrontal cortex makes up in excess of 30% of the brain's weight and surface area and, relative to other cortical regions, is more directly integrated with other brain regions (Royall et al., 2002). Moreover, Royall and colleagues (2002) have posited that "the frontal lobe is the only cortical region capable of integrating motivational, mnemonic, emotional, somatosensory, and external sensory information into unified, goal-directed action" (p. 379) rendering it a logical mediator for executive function.

More specifically, it appears that the anterior cingulate cortex ("located on the medial aspect of the frontal cortex"; Tamminga, 2000, p. 3) is responsible for initiating executive functions. This region, which is typically active during executive tasks such as the Stroop, allows an individual to monitor their own behaviour in a self-reflective manner and detect/correct errors as necessary (Diamond, 2009; Royall et al., 2002). Other neural regions, such as the dorsolateral prefrontal cortex and parietal cortex are typically activated once executive tasks are being performed and executive skills are in use (Royall et al., 2002; Tamminga, 2000).

"Dopamine is critically important for functions of the dorsolateral prefrontal cortex" (Diamond, Briand, Fosella, & Gehlbach, 2004, p. 125). In studies of rhesus monkeys. impairments on tasks requiring working memory and inhibition skills have been shown to occur when dopamine levels in the prefrontal cortex are restricted (Diamond et al., 2004; Diamond, 2007). Diamond and colleagues (2004) administered executive function tasks to 39 healthy, typically functioning children (mean age = 9 years) with and without mutations of the catechol *O*-methyltransferase (COMT) gene. A mutation in this gene has been linked to enzymatic changes affecting the dopamine system of the prefontal cortex (dopamine gets broken down more slowly when the mutation is present). Children with a mutation of the COMT gene (and accompanying enzymatic and neurochemical abnormalities) were found to perform more poorly on a task which measured both working memory skills and inhibition (combined). They performed as well as children without the COMT mutation on a task requiring only working memory skills, but not on a task focused solely on inhibition skills. All of tasks involve the dorsolateral prefrontal cortex. These results suggest that while dopamine may be related to working memory, different domains of executive functioning may be differentially sensitive to

genetic, enzymatic and neurochemical changes in the dorsolateral prefrontal cortex (Diamond et al., 2004).

Significant structural and functional developments in the dorsolateral prefrontal cortex have been shown to occur during late infancy, with the prefrontal cortex becoming operational at some point during the first year of life. This neurological development coincides with significant improvements in the areas of working memory and inhibition at approximately 12 months of age (Diamond, 2009; Epsy, et al., 2001; Garon, Bryson, & Smith, 2008).

While research suggests that executive function skills do not peak until early adulthood, many executive abilities are believed to emerge by around the end of the first year of life (Davidson et al., 2006; Diamond, 2006; Seguin & Zelazo, 2005). Subsequently, from 2-5 years of age, children undergo important changes in their executive function (Liebermann, 2010; Seguin & Zelazo, 2005; Zelazo et al., 1997).

In a study comparing 30 three-year old children to 30 four-year-old children, Zelazo, Frye and Rapus (1996) found that the younger cohort demonstrated greater cognitive perseverance: as the rules of a card sorting-task changed, the younger group of children had more difficulty modifying their behaviour accordingly, despite being able to verbally articulate the new rule in the appropriate context. Zelazo and colleagues (1997) attribute this finding to the younger children's relative deficit in cognitive inhibition, whereby the three-year-old children demonstrate more difficulty inhibiting the cognitive activation of a previously adhered-to social script (Bjorklund, 2005; Diamond, 2006; Zelazo, et al., 1997; Zelazo & Frye, 1998).

The developmental changes which are thought to take place during the preschool years also typically entail gradual developments in the domains of problem representation, planning, goal-directed behaviour and the post-hoc evaluation of one's problem responses (Zelazo et al.,

1997). With these developmental changes, children gain greater control over their thoughts and behaviours when solving problems (Zelazo et al., 1997). Of particular interest to the study of physical aggression is the fact that the chronological timing of these normative executive function developments overlaps with the proposed sensitive period for learning to inhibit aggressive behaviour (Tremblay, 2000; Tremblay, 2001).

Executive function and aggression. There is reason to believe that executive function may play a role in the development of aggression for some children (Diamantopoulou, Rydell, Thorell, & Bohlin, 2007; Dodge et al., 2006; Hughes, Dunn & White, 1998; Hughes & Ensor, 2006; Moffitt, 1993; Seguin & Zelazo, 2005). With regard to trajectories of physical aggression, Seguin and Zelazo (2005) have speculated that executive function deficits may be present within children who demonstrate a pattern of persistent physical aggression across early childhood, yet further research is required to test the validity of this hypothesis.

Although not directly measuring physically aggressive behaviour, Hughes and Ensor (2006) demonstrated that better executive function (as measured by five distinct tasks purportedly measuring: planning, working memory, inhibitory control, rule learning and rule switching) was linked to fewer behaviour problems (i.e., ADHD and emotion regulation) among their sample of two-year olds. Also, Hughes, Dunn and White (1998) found that children who reportedly exhibited a higher frequency of such behaviours as teasing, bullying, and hurting other children, performed more poorly on executive function tasks involving inhibitory control, attentional set-shifting, and working memory.

Moffitt (e.g., 1990; 1993) and colleagues (e.g., Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt & Silva, 1988a; Moffitt & Silva, 1988b) have consistently found links between poor executive functions and delinquency. In these studies, New Zealand boys who demonstrated

consistently high levels of antisocial behaviour from age 3-15 years, and who, by adolescence, had been diagnosed with both attention deficit disorder with hyperactivity (ADD-H) and conduct disorder, tended to obtain considerably poor scores on executive function domains (e.g., mental flexibility and cognitive inhibition).

Cognitive inhibition is a component of executive function that may play a particularly pertinent role in the link between executive function and early childhood aggression. In fact, inhibition deficits may underlie all impairments in executive function (Zelazo et al., 1997). Inhibition is the suppression of a dominant or automatic response in favour of another (presumably more adaptive) response (Bodnar, Prahme, Cutting, Denckla, & Mahone, 2007; Liebermann, Giesbrecht, & Muller, 2007; McAuley, Chen, Goos, Schachar, & Crosbie, 2010). This can include persistence on a task despite significant distractions and allow for the deferral of reinforcement or gratification (Bodnar et al., 2007). Cognitive inhibition makes disengaging, refocusing, and shifting responses possible (Kirkham & Diamond, 2003). By definition, cognitive inhibition skills allow one to resist behaving in a way that was previously functional, in favour of a new response when rules change. Aspects of cognitive inhibition, including self-control (resisting one response in favour of a more adaptive one) and cognitive flexibility (adapting one's perspective, attention or response to match a particular situation), have been shown to typically emerge around 2 years of age, continuing to mature into the elementary school (Diamond, 2006; Welsh, 2002).

Applying the logic of Zelazo and colleagues (1997), it can be argued that that during the first year of life (prior to what may be a sensitive period for learning to inhibit aggressive tendencies at approximately 24-36 months of age) most infants naturally learn to respond to certain situations with physical aggression. Subsequently, by the third year of life, the majority

of children have learned to modify their response tendencies, for example through the use of verbal communication instead of physical aggression (in some instances). It is thought that one reason a minority of children exhibit a high level of physically aggressive behaviour beyond the second year of life relates to an inability to inhibit a previously functional cognitive script for utilizing physical aggression. Specifically, it is possible that many preschoolers who maintain a pattern of high, persistent physical aggression are not able to replace their physically aggressive responses with the application of verbal skills. Thus, according to this argument, children who experience executive function deficits, (especially a relative impairment of cognitive inhibition; Zelazo & Frye, 1998), are more likely to exhibit persistently high levels of physical aggression.

Research by Raaijmakers and colleagues (2008) provides some possible insight into why inhibition might be of particular relevance in understanding physical aggression in childhood. These researchers administered measures to assess verbal working memory, working memory, inhibitory control, shifting and cognitive flexibility (using several individually administered performance-based measures) to 181 four-year-old Dutch children who had been identified to show high levels of aggressive behaviour. Raaijmakers and colleagues (2008) reported that differentiation of the various aspects of executive function during the preschool years is challenging. However, using factor analysis, inhibition was found to be the only aspect of executive function that emerged as significantly related to physical aggression. Accordingly, Raaijmakers and colleagues (2008) indicated that "inhibition is a robust concept" (p. 1104), at least by the time children reach four years of age. Findings from their study suggest that inhibition may develop earlier than some of the other executive skills pointing to an important psychometric issue involving the measurement of executive function within the age group. Although this research identified inhibition as a potentially pertinent predictor of physical

aggression during the early preschool years, this study was limited to an assessment of executive skills in the prediction of physical aggression, and did not assess the relative predictive utility of vocabulary. Moreover, Raaijmakers and colleagues' (2008) research did not allow for an assessment of the predictive power of executive skills at different developmental time points.

In sum, despite evidence to suggest a connection between cognitive skills and physical aggression, it is highly unlikely that the developmental processes that underlie physically aggressive behaviour during the preschool years can be accounted for solely by an examination of cognitive factors (Brennan et al., 2003; Patterson et al., 1989; Reebye, 2005; Tourigny, 2004). Accordingly, an assessment of social-interactional factors was also necessary in order to accomplish a more comprehensive examination of physical aggression.

Social-Interactional Variables

Parenting styles and aggression. According to Baron and Richardson (1994), "the family is the primary source of early socialization" (p. 89). Both parents and children, as well as the relationship they have together, influence the socialization process (Patterson et al., 1989; Tourigny, 2004). Moreover, different parenting strategies can have different effects depending on individual factors associated with both the child (e.g., temperament, distractibility/hyperactivity, age and sex) and the parents (e.g., sensitivity and history of depression; Grusec & Goodnow, 1994; Kochanska, 1997; Tourigny, 2004). In light of previous empirical and theoretical literature, it was deemed useful to incorporate relevant information about the family dynamic (e.g., parenting styles) in which the children are reared, in order to gauge the relative contribution of this variable to the development and normative inhibition of physically aggressive behaviour during the preschool years.

To date, the vast majority of research that has been done to support the existence of a connection between aggression and family management practices has not dealt directly with physical aggression, but rather, has assessed broader variables like "delinquency" (e.g., Loeber & Dishon, 1983) and "aggression" in general (e.g., Eron & Huesmann, 1984; Olweus, 1980; Trickett & Kuczynski, 1986). Accordingly, it was deemed to be beneficial to address the relevance of various aspects of parental management specifically in relation to the development and inhibition of physical aggression. In order to guide such research efforts, however, it is helpful to refer to previous literature, despite the limitation of not distinguishing among the various forms of aggression and antisocial behaviour.

Several distinct parenting styles have been identified. These styles are differentially defined by the attitudes and beliefs adopted by parents toward rearing their child, as well as the "emotional climate" in which these attitudes are expressed behaviourally (Darling & Steinberg, 1993, p. 488). Baumrind (1967; 1968; 1971) identified three parenting styles: authoritative, authoritarian and permissive. Her model of parenting styles purports to concern parents' values, attitudes and beliefs about parenting, children and child development, along with their actual parenting behaviour (Robinson, Mandleco, Frost Olsen, & Hart, 1995).

Baumrind described parents who rely primarily on the authoritarive style as being both controlling and demanding, while also encouraging their child's autonomy through warmth, rationality, responsiveness, emotional supportiveness and receptivity to the child through bi-directional communication (Baumrind, 1971; Darling & Steinberg, 1993; Maccoby & Martin, 1983; Palmer, 2009). These parents often make attempts to reason with their children, while still imparting and monitoring children's adherence to certain standards of conduct (Baumrind, 1971; 1991). Children reared by parents using this style have been found to exhibit a high level of self-

reliance, self-control and self-esteem, coupled with less externalizing and internalizing problem behaviours than children from homes that employ other parenting styles (Bartle, Anderson, & Sabatelli, 1989; Baumrind, 1971; Palmer, 2009; Weiss & Schwarz, 1996).

According to Baumrind (1971) parents who are controlling, but show little warmth in their parenting are authoritarian in their parenting behaviour. Maccoby and Martin (1983) described authoritarian parents as being highly demanding but low in responsiveness. Those who value obedience and who are punitive and forceful in the pursuit of their child's obedience adopt this style of parenting (Baumrind, 1971; 1991). There is little room for verbal negotiations between children and parents. The children of authoritarian parents tend to be "discontent, withdrawn, and distrustful" (Baumrind, 1971, p.2). According to Baumrind (1971) there are two subtypes of authoritarian parents, those who are rejecting and those who are not. A chronic pattern of aggressive behaviour has been shown to be associated with a history of rejecting parenting during the preschool years (Shaw et al., 2003). Overall, outcomes for children reared in an authoritarian environment tend to be negative, particularly as it relates to aggressive behaviour (Baumrind, 1971; Eron & Huesmann, 1984; Palmer, 2009). One possible explanation for this relates to the suggestion that authoritarian parenting leads to children experiencing difficulties with emotion regulation and self-control (Palmer, 2009). Baumrind (1967, 1971) proposed that parental self-control was important in order for successful parenting to occur; greater self-control has been found among children whose parents tend to show a more authoritative (as opposed to authoritarian or permissive) style of parenting (Palmer, 2009). This may relate to the social-interactional explanation of aggression, which proposes that physically aggressive behaviour allows a child to successfully escape parents who are intrusive or emotionally reactive (Brennan et al., 2003; Patterson et al., 1989).

Lastly, Baumrind (1971) described permissive parents, who tend to be neither controlling nor demanding. These parents are typically lenient in their discipline techniques, although they show a high level of warmth (Baumrind, 1971; 1991). This third style is said to be conducive to a lack of self-control, self-reliance and explorative behaviour on the part of children (Baumrind, 1971).

Maccoby and Martin (1983) further subdivided the permissive parenting style into two categories. According to them, indulgent parents are low in demandingness and high in responsiveness, while neglectful parents are neither demanding nor responsive towards their children (Maccoby & Martin, 1983). Baumrind (1991) ultimately embraced Maccoby and Martin's (1983) classification system based on the concepts of demandingness and responsiveness. She revised her model of parenting styles by redefining the permissive style as low in demandingness and high in responsiveness (making this style akin to what Maccoby and Martin termed indulgent) and the rejecting-neglecting style as lacking in both of these defining features (making this style akin to what Maccoby and Martin called rejecting; Baumrind, 1991). According to Maccoby and Martin (1983), the responsiveness domain is comparable to Patterson et al's (1989) concepts of parental sensitivity and appropriate contingent reinforcement. Other parenting styles have been proposed to specifically address family relations during adolescence (Baumrind, 1991), however, given the present focus on preschoolers, a review of these additional parenting styles is not relevant to the current research.

Parenting styles can have a major impact upon a child's development, including the extent to which a child exhibits aggressive behaviour. The use of moderate punishment by parents is thought to be best suited for rearing non-aggressive children (Eron & Huesmann, 1984). Harsh punishment (as typically occurs most often with an authoritarian style of parenting)

has been shown to be associated with high levels of aggression, perhaps as a result of modelling (Bandura, 1973; Eron & Huesmann, 1984). In a study of 49 high-risk children in the United States, aged 2-5 years, Kimonis, Frick, Boris, Smyke, Cornell, Farell, and Zeanah (2006) found that those with parents who had a favourable attitude toward corporal punishment (e.g., spanking) were reported to exhibit higher levels of total aggression and proactive aggression (i.e., unprovoked goal-oriented aggression). Similarly, Olweus (1980) reported that both parents' use of power-assertive discipline techniques (e.g., physical punishment), and a negative maternal parenting attitude (i.e., lack of warmth and a lack of positive regard toward the child) each predicted peer ratings of aggression amongst boys at age 13 (n = 76) and 17 (n = 51). Using path analyses, he further concluded that at both time points, there was a causal impact of mothers' attitudes on the use of power-assertive methods. As the dependent variable in his study, Olweus (1980) used a composite measure of physical aggression against peers, verbal aggression against teachers, and verbal aggression against peers.

Conversely, parental practices characterized by a lack of punishment altogether (i.e., as occurs with a permissive style of parenting) and low levels of parental monitoring (as is the case with neglectful parents) have also been found to relate to high levels of aggression (Eron & Huesmann, 1984; Patterson et al., 1989). For example, Olweus (1980) found that mother's permissiveness for aggression contributed to the development of aggressive behaviour amongst boys aged 13 and 17 years. Although the age of this sample is much older than the population of interest within current research, the results of Olweus' (1980) study are likely still relevant, given the stability of both parenting styles (Forehand & Jones, 2002) and aggressive behaviour (Olweus, 1979).

According to a social-interactional perspective, it can be presumed that neglectful and authoritarian parenting styles would be linked to the highest levels of physical aggression among children in the current study, while authoritative and indulgent parenting styles should be conducive to somewhat lower levels of reported physical aggression among children. This makes sense given that the latter two styles are characterized by high parental responsiveness, which would equate to high levels of parental sensitivity and contingent reinforcement according to Patterson and colleagues (1989). Further, given the respective punishment practices adopted within each of the above styles of parenting, it would be expected that an authoritative parenting style would be associated with the lowest overall levels of physical aggression among children (Baumrind, 1971).

Some theorists would argue that parenting styles likely impact not only a child's behaviour, but the quality of the relationship between the parent and child as well (Bowlby, 1969; Bretherton, Ridgeway, & Cassidy, 1990). "Attachment" is a special type of relationship that exists between parent and child (to be described in more detail below). Empirical evidence has supported the connection between attachment and parenting style. Karavasilis, Doyle, and Markiewicz (2003), for example, investigated the relationship between parenting styles and attachment among a sample of child-mother dyads. A significant positive relationship was found between authoritative parenting and secure attachment, such that children reared with this form of parenting tended to seek both appropriate intimacy and independence within their relationship to their primary caregiver. In contrast, negligent parenting was associated with avoidant attachments (characterized by a general resistance of intimacy with the primary caregiver), among children from grades 4-11.

Attachment and aggression. Aggression during childhood has been associated with the quality of the relationship between the child and his/her parents, such that a negative relationship (e.g., one characterized by experiences of parental unresponsiveness) has been suggested as a predisposing factor for the development of aggressive tendencies (Baron & Richardson, 1994). Parental responsiveness appears to play a crucial role in the normative socialization process involved in the inhibition of physically aggressive behaviour (Shaw, Keenan & Vondra, 1994). A parental relationship that is characterized by unresponsiveness can result in an insecure attachment on behalf of the child, which in turn may predispose the child to antisocial behaviour, including physical aggression (Shaw, Keenan & Vondra, 1994). According to attachment theory (Bowlby, 1969), "caregiver sensitivity, and the resultant bond between parent and infant are important factors in later behaviour patterns of the child" (Shaw, Keenan & Vondra, 1994, p. 356). Children with insecure attachments are thought to have "less to lose by disobeying parental requests" (Shaw et al., 1994, p. 356). In theory then, the quality of an insecure attachment relationship between a child and a parent may not serve to motivate the child to inhibit aggressive tendencies to the same degree that a secure attachment would.

Attachment theory was formulated by John Bowlby in 1969. He hypothesized that attachment evolved as a mechanism to secure infant protection via maintaining proximity between infants and their caretakers (Bartholomew & Horowitz, 1991). The attachment figure is said to act as both a safe haven to which the infant can turn when needed and a secure base for exploration of the child's environment (Kirkpatrick & Shaver, 1990). Theoretically, this early bond can be modified, and different attachment relations can form with different attachment figures, however it is believed that the early infant – caregiver bond serves as a foundation which influences all subsequent relationships throughout an individual's life (Bowlby, 1969). Notably

though, attachment per se does not develop in all types of relationships, only those "in which one person serves as a secure base and secure haven to another" (Bretherton, et al., 1990).

One's attachment orientation is characterized by their representation of self and other (specifically, the infant's view of 'other' is focused on the caregiver; Bartholomew and Horowitz, 1991; Bretherton, et al., 1990). Bowlby coined the term "internal working model" to describe this mental process (Bretherton, et al., 1990). A child who experiences and in turn perceives their caregiver as rejecting will likely construct an internal working model in which the self is represented as "unworthy or unacceptable" (Bretherton, et al., 1990, p. 275). Such an experience (and accompanying perception) will also have negative repercussions for a child's model of others (particularly attachment figures) and for relationships in general (Bretherton, et al., 1990).

Work by Ainsworth, Blehar, Waters, and Ball (1978) outlined three distinct attachment types. According to their typology, a securely attached individual is self-confidant, socially skilled and has a genuine desire to form close relationships. These relationships are likely to be relatively stable, satisfying and long lasting. An infant with a secure attachment orientation relies on the attachment figure to provide comfort in times of distress (e.g., following separation from the caregiver; Renken et al., 1989). Within the insecure category of attachment, avoidant individuals are generally uncomfortable with intimacy and actively avoid the attachment figure during times of distress (Cooper, et al., 2004; Renken et al., 1989). Individuals with an anxious/ambivalent orientation are thought to generally lack self-confidence and fear rejection in close relationships. Although these infants seek contact with their caregivers when distressed, they are not easily comforted (Ainsworth, et al., 1978; Renken et al., 1989). In 1990, Main and Solomon proposed a fourth category of attachment called "disorganized/disoriented". These

individuals are generally less consistent in the way they interpret and behave in relationships (Lyons-Ruth, 1996). The disorganized category has been conceptualized as a lack of a relationship strategy altogether. Some of the behaviours exhibited may include apprehension, helplessness, dysphoria and an unpredictable mix of many of the qualities that define the other three attachment types. Many children who can be classified as insecure/disorganized during infancy may come to adopt an insecure/controlling attachment orientation during their preschool years (Byng-Hall, 2002). The insecure/controlling style of attachment is not applicable to infants, but may develop later, out of early maltreatment experiences. Preschoolers with such an orientation have adopted a survival strategy whereby they care for themselves more independently, often assuring that they are cared for through means that are at times insistent and even coercive (Byng-Hall, 2002; Moss et al., 2006).

During infancy, most individuals (55-65% approximately) typically develop a secure attachment to their caregiver, while about 15% of infants display a disorganized attachment orientation, approximately 12% show an anxious/ambivalent style and 15% show an avoidant style (Lyons-Ruth, 1996; Moss et al., 2006). The four attachment styles mentioned above are not meant to be regarded in a rigid, strictly categorical manner, however. Rather, attachment can be measured on a continuum from less secure to more secure. Also, it should be noted that other models of attachment have been proposed to explain attachment styles in adulthood (e.g., Bartholomew and Horowitz, 1991). The model that was developed by Ainsworth, Blehar, Waters, and Ball (1978) and later expanded upon by Main and Solomon (1990), however, is the most commonly used typology to describe the attachment styles of young children and infants (Byng-Hall, 2002).

Shaw and colleagues (1994) have implied that the security of a child's attachment with their primary caregiver should mediate a relationship between caregiver unresponsiveness and the child's use of physical aggression. Specifically, a lack of caregiver responsiveness would be related to a poor relationship quality between parent and child, which, in turn, would predict the child's level of physical aggression. Accordingly, in the present study it was hypothesized that attachment would similarly mediate a relationship between parenting style (which encompasses unresponsiveness) and physical aggression. It seems plausible that parenting may have an impact on attachment, which in turn more directly impacts the development of physically aggressive behaviour.

In order to empirically demonstrate a mediation effect of attachment, it would be essential to demonstrate three relationships: (1) A relationship between parenting styles and physical aggression (2) A relationship between parenting styles and attachment and (3) A relationship between attachment and physical aggression. Subsequently, in order for attachment to be considered to mediate, the statistical relationship between parenting styles and physical aggression should significantly decrease once attachment has been accounted for (Baron & Kenny, 1986).

Some research has previously been done to assess the connections between parenting styles and aggression. In a study of 100 mothers and infants from low-income families in the United States, Shaw and colleagues (1994) confirmed their prediction that maternal unresponsiveness was related to aggressive behaviour. Specifically, these researchers found that maternal unresponsiveness at 12 months of age predicted global aggression at 24 months of age. This research did not, however, assess the relevance of child attachment. It should also be noted that physical aggression was not directly addressed in this study. Moreover, much of the data

was only collected at one time point (e.g., maternal unresponsiveness was only obtained when children were 12 months of age). Thus, Shaw et al. (1994) recommended that further research be done to assess the relationship between caregiver unresponsiveness and child aggression from age 24 to 36 months of age.

Other researchers have found support for a relationship between attachment security and aggressive behaviour. Using several parent-report measures, Marcus and Kramer (2001) reported an association between attachment insecurity (of the child towards their mother) and both reactive (i.e., retaliatory) and proactive (i.e., unprovoked) forms of aggression in a study of 107 boys and girls ranging from 3 to 8 years of age. This age range is rather large and limits the degree to which the study contributes to our knowledge of the development of aggression, during the preschool years in particular. Moreover, it may be problematic to make specific inferences about the role of attachment security in the development of physical aggression, as physical aggression can be viewed to overlap with both reactive and proactive aggression; both reactive and proactive forms of aggression may or may not involve physical aggression. Nonetheless, Marcus and Kramer's (2001) work lends support for the notion that attachment may play a role in the development of certain types of aggressive behaviour.

Moss and colleagues (2006) reported evidence of both the insecure/ambivalent and insecure/controlling orientations relating to externalizing behaviour, in a study of 96 French Canadian children. Children's attachment to their primary caregiver was measured via observation of children's separation from and reunion with caregivers, when they were approximately six years of age. Relative to securely attached children, those with either controlling or ambivalent orientations were found to show higher externalizing behaviour at age six and eight years of age, according to self, parent and teacher reports (Moss, et al., 2006).

Similarly, a disorganized attachment style during infancy has also been found to be particularly associated with aggressive behaviour (Lyons-Ruth, 1996). In a study of 62 children from low-income families, Lyons-Ruth, Alpern and Repacholi (1993) examined the relationship between attachment at 18 months and behaviour problems at 5 years of age. Using the Ainsworth Strange-Situation (Ainsworth, Blehar, Waters, & Ball, 1978) to assess infant attachment styles, Lyons-Ruth and colleagues (1993) found that 71 percent of those children who were reported by their kindergarten teacher (at age 5) to demonstrate a deviant level of hostility towards their peers had been classified as having a disorganized attachment style in infancy. Consequently, Lyons-Ruth and colleagues asserted that a disorganized attachment orientation in infancy serves as a "precursor of later maladaptation" (p. 582). Moreover, Lyons-Ruth and colleagues (1996) also suggested that the optimal time for measuring disorganized attachment for the purpose of predicting later behaviour problems comes at around 18 months of age, as this is the time when the use of disorganized attachment strategies appears to become solidified.

According to Renken and colleagues (1989) an avoidant attachment style has been found to relate to high levels of aggression during the preschool years as well. These researchers reported that an avoidant attachment style during infancy (age 18 months) was significantly correlated with high levels of teacher reported aggression among boys (but not girls) in Grades 1, 2 and 3. Renken et al. (1989) assert that an avoidant attachment orientation develops in response to parental "abandonment" (i.e., rejection and unavailability), which leads to an "angry response" on behalf of the child, precluding the typical need to seek closeness with caregivers (p. 259). Given that a negative working model of others (i.e., attachment figures) is a defining feature of the avoidant attachment style, theoretically, it comes as no surprise that aggression towards others has been associated with this attachment orientation.

All in all, it seems that strong links have previously been found to suggest a relationship between attachment and physical aggression. Moreover, as discussed earlier, there seems to be evidence to imply that there are also relationships between parenting style and aggression (e.g., Bandura, 1973; Eron & Huesmann, 1984; Kimonis et al., 2006; Olweus, 1980) and between parenting styles and attachment (Karavasilis et al., 2003). However, no study to date has assessed whether the relationship between parenting style and physical aggression decreases significantly once the role of attachment is accounted for. The current research aimed to address this possibility.

The rationale for the mediation hypothesis pertains to the idea that the *impact* or *consequence* of parenting behaviour (i.e., the resultant attachment bond that develops), is more directly tied to the development of physically aggressive tendencies among preschool children than are the objective parenting behaviours alone. This mediatory connection makes sense theoretically, given Bowlby's (1969) assertion that attachment follows from the child's early experiences with their caregiver (i.e., caregiver sensitivity).

Moreover, the degree to which attachment accounts for the relationship between parenting style and aggression may vary according to developmental timing. Specifically, the proposed sensitive period for learning to inhibit physical aggression (24-36 months of age) may be a time when children are most susceptible to the *socialization* of aggressive behaviour. And, attachment has been related to socialization in general, as an insecure attachment orientation tends to be associated with *less receptivity towards socialization* (because of the fact that insecurely attached children tend to be less prosocial; Marcus & Kramer, 2001). Accordingly, it could be hypothesized that relative to any other developmental time point, during the proposed sensitive period (a period where the socialization for aggressive behaviour may be optimally

effective), the role of attachment as a mediator should be especially strong. Thus, if attachment does mediate the relationship between parenting style and aggression, it seems plausible that this could be most readily detected during what may be a sensitive period for learning to inhibit physically aggressive behaviour.

Establishing Evidence for a Sensitive Period

Within the realm of developmental psychology, it is very difficult to establish evidence for sensitive periods of any kind. Indeed, the third volume (social, emotional, and personality development) of the Handbook of Child Psychology (Eisenberg, Damon, & Lerner, 2006) does not address any sensitive or critical periods at all. This is probably a function of the inherent difficulty in establishing clear sensitive periods in a human sample, particularly within the realm of psychological phenomenon, and even more so within developmental psychology. In order to properly test the validity of a critical or sensitive period, rigorous scientific investigations are required.

One oft-cited example of a critical period was discovered by David Hubel and Torsten Wiesel (1970). Their research showed that unless kittens receive visual input during the first 6 weeks after birth they become permanently blind (Bruer, 2001). This type of research should be differentiated from research surrounding sensitive periods, however. Traditionally, a critical period has been characterized by a brief, well-defined period in an organism's development, during which a particular experience (or lack thereof) has a permanent and irreversible impact on the organism (Bruer, 2001). This was established to be the case in Hubel and Weisel's (1970) research involving kittens.

Rarely, can such a clear period in development be delineated, whereby the effects of experiences within the critical period are assuredly permanent. Accordingly, many scientists

have come to favour the use of the term "sensitive period". The important semantic distinction to make here is that, compared to critical periods, sensitive periods are usually documented as being temporally longer, less well-defined (i.e., there is not necessarily a definite start or end point) and can refer to developmental periods during which specific experiences (or lack thereof) seem to have particularly potent effects. These effects, however, may be reversible or still somewhat meaningful outside the sensitive period (Bruer, 2001). Moreover, the term sensitive period usually connotes a time when a developmental trajectory changes as the result of some experience (or lack thereof), whereas a critical period is more often a window of opportunity for reversing a developmental change that has already taken place (Bruer, 2001). As a result of its conceptually broader and less rigid definition, the use of the term sensitive period is generally favoured among researchers in the area of developmental psychology (Thompson, 2001).

According to Bruer (2001), in order to establish the existence of a sensitive period, researchers must demonstrate that "an experience (or lack of it) during a given period in development has a more pronounced effect (positive or negative) on the organism than exposure to that same experience at any other time during the organism's development" (p. 12). Therefore, a study of this nature must include an outcome measure to test the effect of a particular experience at different times during the organism's development. In experimental studies, an organism would be given the same experience at different periods in development in order to test the relative impact of the experience at each time point. It is imperative that the experience which is thought to influence the organism must be equivalent in potency and duration at each of the time points during the investigation. The duration or magnitude of such an experience must be held constant in order to make inferences regarding its effect relative to the developmental timing of the experience itself. For example, in Hubel and Weisel's (1970) experiment it was

necessary that the duration of the visual input deprivation be the same whether the kittens had this experience immediately following birth or at age 3 months (Bruer, 2001).

Within the realm of social and emotional developmental research, establishing a sensitive period is often methodologically more difficult. For example, the question of whether or not there is a sensitive period for the development of a secure attachment style has been considered (Thompson, 2001). It was believed that infants' early maternal care experiences were fundamental influences upon their later relationship experiences. However, given ethical constraints, it is difficult to test the impact of what was believed to be healthy versus unhealthy early care experiences. This type of research is not conducive to the type of rigid and controlled experimentation that Hubel and Weisel (1970) were privy to when they were conducting their research. Accordingly, sensitive period research on the study of attachment has had to rely primarily on naturalistic observational data collection methods. For example, longitudinal studies have been conducted on the impact of children's attachment relationships at different ages following early experiences within various types of residential care facilities (e.g., orphanage; Thompson, 2001). For the most part, such research has demonstrated remarkable resilience on the part of the children. Despite having been exposed to high staff turnover rates at an early age and in some cases having been the victims of severe neglect, many children still develop healthy and secure attachments to adoptive parents. However, secure attachments have been found to be more likely to develop if the child was adopted prior to their first birthday (Thompson, 2001). This offers support for the existence of a sensitive period for the development of a secure attachment to one's parents, as the experience of adoption appears to have a more pronounced effect on a child's development prior to 12 months of age, than the same experience after 12 months of age.

The distinction between a sensitive period and a critical period can be seen in Thompson's (2001) example. The closer children are to a sensitive period, the more potent the effect of the influencing variable would be. In the case of attachment and adoption, adoption at 13 months would likely have a stronger impact upon a child's attachment than would adoption at 3 years of age, even though both of these adoptions would technically be occurring outside of the sensitive period. This would not be true, however, if there were a critical period for the development of a secure attachment style, as critical periods have a definitive end point (Bruer, 2001).

A Possible Sensitive Period for Learning to Inhibit Physically Aggressive Behaviour

Tremblay (2000; 2001) has advocated that there is a "sensitive" period at approximately two to three years of age, during which most children learn to inhibit their propensity for aggression. Relative to critical periods, which are typically briefer and with clearly defined age posts, the sensitive period proposed by Tremblay (2000; 2001) is a rather large window and leaves the temporal boundaries for learning to inhibit physically aggressive behaviour somewhat unclear. Previous research has established a normative developmental pattern of aggression in children, whereby physical aggression typically increases during the second year of life and peaks between 24 and 36 months of age (Tremblay, 2000; Tremblay, 2001). Subsequently there is generally a consistent decline in physically aggressive acts thereafter (Arsenio, 2004a; Cote et al., 2007; Cote et al., 2006; Gauthier, 2003; Tremblay, 2000; Tremblay, 2001). However, not all children follow the above trajectory of declining aggressive behaviour, with researchers reporting that roughly four to fifteen percent of children follow a chronically high pattern of physical aggression (Brennan, et al., 2003; Cote, Vaillancourt, Barker, Nagin, & Tremblay,

2007; Cote et al., 2006; Dodge et al., 2006; Gauther, 2003; Moffitt, 1993; Thomas & Guskin, 2001; Tremblay, 2000; Tremblay, 2001).

Much attention has been given to the early-onset pattern of physically aggressive behaviour and various findings have, albeit rather indirectly, supported the notion of there being a sensitive period at some point very early during development. In fact, late-onset physical aggression (i.e., after 6 years of age) appears to occur rarely, if at all (Nagin & Tremblay, 2005; Brame et al., 2001; Tremblay, 2001). Although this finding does not relate to a direct test of whether there is a sensitive period for learning to inhibit physical aggression, it does suggest that the preschool years are of primary importance to the development of aggressive behaviour. Furthermore, the treatment of conduct problems has been shown to be more effective when employed with younger children who have not yet reached school age (Banaschewski, 2010; Dishion & Patterson, 1992; Patterson, DeBaryshe, & Ramsey, 1989). This implies that children more easily learn to inhibit these behaviour problems at an early age, lending support for the notion that developmental timing is a crucial factor with regard to the inhibition of physical aggression.

Similarly, many programs geared toward improving the academic success and social skills of school-age youth have had low levels of success in reducing antisocial behaviours like physical aggression, particularly relative to programs targeting preschool children (Bierman, 2003; Banaschewski, 2010; Eron & Huesmann, 1984; Patterson, et al., 1989). All of the above findings would make sense if there were indeed a sensitive period between 24 and 36 months for learning to inhibit physically aggressive behaviour. If this were the case, it would be expected that a tendency toward physical aggression would be more resistant to change beyond the sensitive period, regardless of the nature of any experiences or intervention efforts.

If indeed developmental timing matters and a sensitive period for the inhibition of physical aggression does exist during the preschool years, a model of developmental psychopathology would suggest that there are likely multiple explanatory mechanisms through which this period may be particularly important (Cicchetti, 2006; Rutter, 2010). The resistance to efforts aimed at fostering the inhibition of aggressive behaviour may pertain to the relevance of peer influences upon school entry (Junger & Tremblay, 1999; Patterson et al., 1989). "Deviant peer groups" (Patterson et al., 1989, pp. 330-331) likely counter intervention attempts which might otherwise alter the reinforcement contingencies for aggression and change children's perceptions about the perceived necessity for using physical aggression. Specifically, once aggressive children enter school, they have been given the opportunity to become involved with peer groups who provide reinforcement for deviance, and punishment or sanctions for what is typically thought to be prosocial behaviour (Patterson et al., 1989). Accordingly, patterns of aggression usually appear to be well-established prior to middle childhood (Bierman, 2003; Eron & Huesmann, 1984).

Given the relation between physical aggression and cognitive abilities (e.g., executive function and language), however, the concept of neural plasticity may also be relevant to the possibility of a sensitive period for the inhibition of aggressive behaviour (Rutter, 2010). Neural plasticity refers to the ability of the brain to adapt and change so that new neural pathways can be developed (Thomas & Johnson, 2008). Functional plasticity is an organism's corresponding ability to change behaviour based on experience (Knowland & Thomas, 2009). If there is any direct causal relationship between cognitive development and physical aggression, the period from 24-36 months may be a period at which children are most receptive to cognitive developments which subsequently influence the manifestation of physically aggressive

behaviour. There is a debate in the literature regarding whether sensitive periods are merely a direct consequence of natural brain development (Thomas & Johnson, 2008). This view holds that the termination of a sensitive period is marked by cortical regions becoming sufficiently defined and specialized such that changes become "difficult to reverse" (Thomas & Johnson, 2008, p. 1). In fact, at one point, it was believed that the learning and neural development which took place within a critical period was irreversible. This has since been refuted, however (Thomas & Johnson, 2008). As Knowland and Thomas (2009) affirm: "After the closing of the sensitive period, some level of plasticity is nevertheless retained; windows of plasticity do not shut suddenly or firmly" (p. 17). The current research does not address the explanatory mechanisms behind a possible sensitive period for physical aggression. However, if there is indeed a sensitive period for physically aggressive behaviour during the preschool years, a developmental psychopathology model would suggest that the normative biological, psychological and social developments which typically take place prior to age 36 months may all be important prerequisites for the inhibition of physically aggressive behaviour.

Much research remains to be done before a conclusion can be reached regarding the possibility of there being a sensitive period for the inhibition of physical aggression. The present research design was not intended to allow for a definitive conclusion either for or against the existence of a sensitive period. Rather, the intention was to explore the possibility of a sensitive period by comparing results from samples spanning two different age groups in the preschool years, that were differentially closer to the proposed sensitive period. It is believed that the closer a child is to the proposed sensitive period, the greater the degree of functional plasticity for the development and inhibition of physical aggression (as "windows of plasticity" begin to close gradually; Knowland & Thomas, 2009, p. 17). While existing theory and research may suggest

that the preschool years could be a more optimal time to target physical aggression than following school entry, no research has assessed whether there may be a difference in the impact of developments or interventions at different points across the preschool years.

No study to date has been rigorous enough to empirically test the existence of a sensitive period for the regulation of physical aggression. This is likely due to the inherent difficulties in testing this sensitive period hypothesis. For example, there is not one clearly defined experience or lack of experience that can be thought to instigate the inhibition of physical aggression. It is believed that executive and vocabulary gains at the time of the proposed sensitive period are among several precipitating factors in the inhibition of aggression. However, research has clearly shown that there is no single factor that can completely account for children's demonstrated levels of aggression. Thus, if there is a sensitive period, it is likely that a combination of several factors interact to encourage the inhibition of physical aggression during this period. Notwithstanding the complexities of demonstrating a sensitive period, the existence of a sensitive period should mean that changes (i.e., growth) in areas thought to pertain to the inhibition of physically aggressive behaviour have a greater relation to physically aggressive behaviour during that period (or closer to that period) compared to similar changes at any other

The search for evidence of a sensitive period lends itself to the use of comparative samples representing different developmental periods. To this end, the present study aimed to examine the overall change in physical aggression at two time periods including approximately 24-36 months and 36-48 months of age. Practical considerations required that these age ranges remain somewhat flexible however, and as such, some older children were included in each of the two samples (to be discussed below). The expectation here was that the existence of a sensitive period for learning to inhibit aggressive behaviour should mean that similar levels of

change in each of the target variables of interest (i.e., executive function, receptive vocabulary, or expressive vocabulary) would be associated with greater levels of change in physical aggression among a younger sample of children which more closely approximates the proposed sensitive period (thought to occur from 24-36 months of age), as compared to the magnitude of the relationship (change in skill covarying with change in physical aggression) tested at a later developmental period. If levels of change in executive function and/or vocabulary are associated with greater change in physical aggression among a younger sample of children then this would support the notion of there potentially being a sensitive period at an early developmental time point (e.g., 24-36 months).

The Present Research

In the context of the present research, it is believed that prior to the proposed sensitive period for learning to inhibit aggressive tendencies (Tremblay, 2001), children have learned that physical aggression is a means of acquiring resources. The extent to which such behaviour is an effective strategy likely depends largely upon family management practices (e.g., parenting styles) and the relational dynamic between the child and his/her caregivers (e.g., attachment; Patterson et al., 1989). According to a Vygotskyian social-interactional perspective (Wertsch & Tulviste, 1992), the extent to which aggression is a successful means of behaviour impacts a child's ensuing cognitive development.

Between two and three years of age, most children appear to replace physically aggressive tendencies in part with an increased use of verbal skills. A minority of children, however, continue to engage in an inappropriately high level of physical aggression, potentially due in part to a cognitive inhibition deficit (a continued reliance on the previously learned script of utilizing physical aggression to achieve goals), and/or underdeveloped vocabulary knowledge.

Theoretically, these cognitive deficits are ultimately derivatives of the social context within which the individual child functions (Wertsch & Tulviste, 1992). This view coincides with Brennan and colleagues' (2003) model of incorporating both social and cognitive explanations for aggressive behaviour, and fits within the larger developmental psychopathology framework, as this is a potential path which could theoretically explain physically aggressive behaviour. There are certain to be other paths, linked to other risk or resilience factors not addressed in the current research, however the interest here is on exploring the cumulative and relative predictive power of both cognitive (executive function and language skills) and social-interactional variables (attachment and parenting styles).

The purpose of Study 1 was to address one aspect of the primary research question. Specifically, this study considered the relation between physical aggression and two cognitive variables (language skills and executive function) in order to assess the cumulative and relative predictive power of each during the latter preschool years. Moreover, specific subdomains of both language skills (i.e., receptive and expressive vocabulary) and executive function (inhibition shift, emotional control, working memory and planning/organizing) were assessed in relation to physical aggression in order to assess relative and cumulate predictive power. Subsequently, Study 2 incorporated measures of these same cognitive variables, while also attending to social-interactional-factors (i.e., attachment and parenting style) once again in an effort to assess the relative and cumulative predictive ability of these variables in relation to physical aggression.

It was expected that negative relationships would emerge between early childhood physical aggression and executive functioning, as well as between physical aggression and both receptive and expressive vocabulary, such that better skills (in verbal and executive domains) would be tied to less physically aggressive behaviour. Further, according to the social-

interactional model of physical aggression that is presented herein, developments in either verbal or executive domains over time, should correspond with a decreased reliance on physically aggressive behaviour strategies. Of interest in the current research is the question of whether or not cognitive developments (i.e., gains in either the verbal or executive domains) that are well beyond the proposed sensitive period for learning to inhibit physical aggression are as strongly tied to children's behavioural tendencies toward physical aggression as are gains at an earlier point in development, thought to be proximally closer to the proposed sensitive period (i.e., is there any preliminary evidence to support the notion of a sensitive period for learning to inhibit physically aggressive behaviour?).

An additional goal of the present study was to be in a position to comment on whether different theoretical perspectives (social-interactionism, Patterson et al., 1989; control theory, Foshee & Bauman, 1992; Moffitt's 1993 cognitive model, or Brennan et al.'s, 2003 cumulative risk factor model) as measured by specific factors (i.e., verbal ability, executive functioning, parenting style, attachment quality) are supported by the present studies. It is believed that no one theory (or set of predictors) can completely account for the development of physically aggressive behaviour, as there are thought to be numerous developmental pathways which could lead to physically aggressive tendencies (equifinality; Cicchetti, 2006; Cicchetti & Rogosch, 1996; Gollan, et al., 2005; Reebye, 2005). However, testing the relative (e.g., which variables emerge as uniquely predictive with other effects controlled) and cumulative impact of the predictor variables of interest (e.g., how much variability in physical aggression can be accounted for when all predictors are included) was expected to nevertheless provide theoretical insight. According to Patterson and colleagues (1989), the social-interactional factors (i.e., parenting style and attachment) should be most strongly related to children's reported levels of

physical aggression. Moreover, if attachment were to show a substantially greater relative impact on the prediction of aggression than any of the other predictor variables (i.e., parenting styles, verbal skills and executive function) then it may be concluded that control theory best explains the results of study 2. Conversely, according to Moffitt's (1993) theory, the cognitive variables (i.e., executive function, receptive vocabulary and expressive vocabulary) should carry more weight in predicting physical aggression than the social-interactional variables. Lastly, according to Brennan et al (2003), a cumulative model, which incorporates both cognitive and social-interactional variables, should best explain reported levels of physical aggression. It is expected that a combination of cumulative risk factors involving executive function, vocabulary, parenting style and attachment would best predict physical aggression and its inhibition (Brennan et al., 2003).

Study 1

Previous research suggests that language difficulties and less mature executive functioning may be connected to aggression during the preschool years (e.g., Hughes & Ensor, 2006). Although both language difficulties and executive functioning have been implicated as predictors, no study to date has considered the relative or cumulative impact of these factors on physical aggression in early childhood. Moreover, very few studies have considered both expressive and receptive vocabulary skills in relation to physically aggressive behaviour.

It is believed that prior to the proposed sensitive period for learning to inhibit physically aggressive tendencies (Tremblay, 2001), children learn that physical aggression is a functional means of acquiring resources (Dodge et al., 2006; Patterson, DeBaryshe & Ramsey, 1989). Subsequently, between two and three years of age, most children learn to decrease physically aggressive behaviour Arsenio, 2004a; Cote et al., 2007; Cote et al., 2006; Gauthier, 2003;

Tremblay, 2000; Tremblay, 2001). Verbal ability is thought to support the socialization process that takes place during the early preschool years, in what may be a sensitive period for learning to inhibit physical aggression (Dodge et al., 2006; Kyung-Hye, et al., 2007; Tremblay, 2000). Further, sufficient verbal ability may facilitate the use of alternate behavioural strategies for some children, including relational aggression (Bonica, et al., 2003) and indirect aggression (Vaillancourt, Miller, Fagbemi, Cote, & Tremblay, 2007). Cognitive inhibition (the ability to deviate from previously learned scripts, such as the use of physically aggressive behaviour) and other elements of executive function are also thought to contribute to the inhibition of physical aggression for some children as well, during what may be a sensitive period for decreasing physical aggression (Baron & Richardson, 1994; Brennan et al., 2003; Moffitt, 1993). It seems likely that the use of physical aggression, language development and executive function may be reciprocally related, whereby high levels of physical aggression are affected by both language skills and executive function, and the development of executive function and language are also influenced by what a child has learned about the use and consequences of physical aggression in his or her environment (Patterson, et al., 1989; Wertsch & Tulviste, 1992).

In Study 1, a group of toddlers (primarily outside the proposed sensitive period; described earlier) was followed over one year. It was expected that both concurrent and predictive relationships would emerge between high levels of early childhood physical aggression and poor executive functioning (in particular cognitive inhibition), as well as between higher physical aggression and both lower receptive and lower expressive vocabulary. Further, developments (i.e., gains) in either verbal or executive domains over time were expected to correspond with a decreased reliance on physically aggressive behaviour strategies. Although based on the existing literature it was not possible to make predictions regarding which factor (language skills or

executive functioning) would show the strongest connection to physical aggression, it was nevertheless interesting to examine the relative impact of these factors in this study. With regard to the cumulative effects of language skills and executive function it was predicted that the combination of both language skills and executive function should account for more of the variance in physically aggressive behaviour (and changes in physically aggressive behaviour) than either language or executive function alone.

Study 1 Hypotheses

H1: Better expressive vocabulary would be associated with and predictive of lower physical aggression (concurrently).

H2: Better receptive vocabulary would be associated with and predictive of lower physical aggression (concurrently).

H3: Greater levels of executive dysfunction would be associated with and predictive of higher levels of physical aggression (concurrently).

H4: Gains in expressive and/or receptive vocabulary over a one year period would be associated with decreases in physical aggression over this same time period.

H5: Declines in executive dysfunction (i.e., improvement) over a one year period would be associated with decreases in physical aggression over this same time period.

Study 1 Method

Participants

Study 1 involves archival data collected by researchers at McMaster University in 2004-2005. At Time 1 of data collection, participants included both parents and teachers who reported on a total of 436 children between the ages of 25 and 74 months. The use of multiple informants in aggression research has been recommended by DiGiunta and colleagues (2010). In keeping

with the goals of the present study, only children aged 30 months and older were included in the final analyses (M_{age} = 42 months, *SD* = 7.88). Specifically, in order to eliminate outliers, and provide a more homogenous sample that is representative of children who have approached or passed the proposed sensitive period for learning to inhibit aggressive behaviour 16 children were eliminated from the sample at Time 1, leaving a total of 423 participants. Within this sample, 222 (53%) children were male and 198 (47%) were female (the sex of three of the children is unknown). The largest proportion of parents reported that they were "married" (47%), with an additional 27% being "legally separated" and 16% reporting themselves as "single". The remaining 10% of parents were either "common law", "divorced" or "widowed". Almost half (47%) of parents reported a household income of $71,000 or greater, with the remaining participants reporting lower incomes. In terms of ethnicity, the majority of the parents reported that they were White (85%). Smaller numbers of parents reported being Black (3%), Native/Aboriginal, (2%), or Latin American (2%).

At Time 2, a sub-sample of parents and teachers, reported on 126 of the original children. This sample was reduced to 122, in order to create a restricted interval between Time 1 and Time 2 data collection. That is, following this sample reduction the time between Time 1 and Time 2 data collection ranged from 10-18 months, with the mean being 15 months. At Time 2, 65 (53%) were males, and 57 (47%) of the children were females. Children ranged in age from 40 to 75 months (mean = 54.55, *SD* = 6.78).

Procedure

Participants were recruited from 40 child-care centers within the South-Western Ontario region. Prior to data collection, parents were sent letters of invitation describing the study and were asked to provide consent (see Appendices A-B for consent and debriefing forms). Teachers

were similarly invited to contribute information on children for whom parental consent had been obtained. Both parents and teachers provided questionnaire information pertaining to children's cognitive functioning and behaviour (described below). In addition, participating children were individually administered two subtests from the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (described below; WPPSI-III, 2002). The administration of the WPPSI-III was carried out by a trained research assistant in a quiet area of the child's classroom.

Measures

Background information. Parents were each asked to provide demographic information concerning information about the child (e.g., age and sex) and the respondent (e.g., highest level of education achieved and marital status; see Appendix C).

Physical aggression. The Child Behaviour Survey (CBS) was also employed in the current research (see Appendix D). In Study 1, both parents and teachers completed this measure at Time 1, while only parents were asked to complete the measure at Time 2. Accordingly, there is no CBS data from teachers at Time 2. This was done in the interest of abbreviating the questionnaire packages for daycare teachers, in order to maximize participants.

The CBS is a measure taken from the National Longitudinal Survey of Children and Youth (NLSCY; Statistics Canada, 2007a; Statistics Canada, 2007b). Provided with a choice of three responses (0 = "never or not true", 1 = "sometimes or somewhat true", 2 = "often or very true"), CBS respondents rate the frequency with which the child engages in each of the stated behaviours (Cote et al., 2007). In Study 1, three of the CBS items were used to assess physical aggression: "kicks, bites, hits other children," "gets into many fights," and "physically attacks people". In the NLSCY, the first two items were deemed applicable to children from 2-11 years of age, while the latter item was administered to children from 4-11 years (Statistics Canada,

2007b). Despite some of the participants in Study 1 being younger than the NLSCY cutoff of 4 years, all participants were administered the three item version of this measure in order to maximize consistency. The measure of physical aggression obtained from parents at Time 1 consisted of the mean of responses on the three items: "kicks, bites, hits other children", "gets into many fights", and "physically attacks people" with higher scores indicative of greater physical aggression. Corresponding mean scores were created for parents at Time 2 and teachers at Time 1. In Study 1, reliability coefficients for this measure were found to be good (T1 parent alpha = 0.79; T2 parent alpha = 0.79; T1 teacher alpha = 0.87).

Executive function. The Behaviour Ratings Inventory of Executive Functioning – Preschool Version (BRIEF-P; Gioia, Epsy, & Isquith, 2003) is a 63-item questionnaire, designed to assess various aspects of executive function among children aged 2-5 years. This is purported to be one of the more ecologically valid measures of executive function as it asks respondents to rate their perceptions of children's executive skills (Gioia et al., 2002). The BRIEF-P is a measure of executive dysfunction, whereby items pertain to behaviours which are presumed to be indices of executive abilities. McAuley and colleagues (2010) found that BRIEF (for children 6-15 years) scores did not relate strongly to performance-based tasks of executive function, suggesting that executive behaviours may not be strongly tied to what performance-based tasks measure. Although this finding appears to argue against the use of the BRIEF and BRIEF-P as measures of executive skills given a supposed lack of concurrent validity, this finding may also be related to the inherent differences between laboratory performance and real-world behavioural expressions of executive function. The BRIEF-P is presumed to allow for an assessment of how children's executive skills are perceived to impact their behaviours in natural settings, (i.e., the application of executive function; Gioia et al., 2002; Gioia et al., 2003; Liebermann et al., 2007).

The norms for this test were developed using a standardization sample of 460 parents and 302 teachers in the United States. The BRIEF-P yields five clinical scale scores (Inhibit, 16-items, e.g., "is impulsive"; Shift, 10-items, e.g., "is upset by a change in plans or routine"; Emotional Control, 10-items, e.g., "mood changes frequently"; Working Memory, 17-items, e.g., "has a short attention span"; and Plan/Organize, 10-items, e.g., "when instructed to clean up, puts things puts things away in a disorganized, random way"; Gioia, Espy, & Isquith, 2003, pp. 17-19). From these scales three index scores can be calculated (Inhibitory Self-Control, which is a combination of the Inhibit and Emotional Control scales; Flexibility, which is a combination of the Shift and Emotional Control scales; and Emergent Meta-Cognition, which is a combination of the Working Memory and Plan/Organize scales) along with an overall score (the Global Executive Composite). T-Scores can be calculated in order to allow for standard estimates of children's executive function. The internal consistency of the clinical scales and index scores ranges from .80-.95 for parents and from .90-.97 for teachers (Gioia, Espy, & Isquith, 2003). The test-retest reliabilities of the clinical and index scores ranges from .78-.90 and .65-.94 for parents and teacher, respectively (Gioia, Espy, & Isquith, 2003). Respondents rate the frequency with which children engage in stated behaviours using a 3-point-likert response scale, whereby 1 = "Never", 2= "Sometimes", and 3 = "Often". Higher scores (raw scores, t-scores, or percentiles) on any of the scales or indexes represent greater dysfunction in the respective domains of executive function and t-scores equal to or greater than 65 are indicative of clinically significant dysfunction (Gioia, Espy, & Isquith, 2003).

In the current research, raw scores (rather than scaled scores) were used in analyses and reliability coefficients for the BRIEF-P clinical scales were found to be satisfactory. Cronbach's

Alpha values at two time points and across two different raters in the present study can be found on Table 1.

The BRIEF (used with children aged 5-18 years) and BRIEF-P have both demonstrated evidence of convergent validity (i.e., the degree to which a measure correlates with theoretically related constructs; Gioia, 2000; Gioia, et al., 2003; McCandless & O'Laughlin, 2007). As no comparable rating scales of executive function exist, evidence of convergent validity for the BRIEF and BRIEF-P have been gathered by correlations with rating scales of attention and behaviour, such as the Behaviour Assessment System for Children (BASC), the Child Behaviour Checklist (CBCL) and the ADHD Rating Scale-IV, Preschool Version (ADHD-IV-P). Specifically, small to moderate significant correlations (0.24; working memory to 0.59; Inhibit) have between observed between all subscales of the BRIEF and the BASC Hyperactivity Scale (McCandless & O'Laughlin, 2007). Moderate significant correlations were also found between this BASC scale and the Inhibit (r = 0.68), Emotional Control (r = 0.52) and Plan/Organize (r = 0.63) subscales of the BRIEF-P (Gioia et al., 2003). Also theoretically consistent, the five BRIEF-P subscales have shown small (e.g., r = 0.30; Shift) to moderate (e.g., r = 0.69; Inhibit) significant correlations with the Attention Problems, Emotional Reactivity and Aggressive Behaviour subscales of the CBCL (Gioia et al., 2003). Finally, as executive dysfunction is thought to be characteristic of children with Attention-Deficit/Hyperactivity Disorder (ADHD), Gioia and colleagues (2003) demonstrated significant correlations between the five BRIEF-P subscales and the Inattention and Hyperactivity scales of the ADHD-IV-P (ranging from r = 0.49; Shift to r = 0.88; Working Memory). As these relations can all be expected conceptually, the BRIEF-P can be considered to have good convergent validity (Gioia et al., 2003; McCandless & O'Laughlin, 2007).

Table 1

Cronbach's Alpha Values for BRIEF-P in Study 1

Measure	Inhibit	Shift	EC	WM	P/O
T1 Teacher	0.95	0.88	0.93	0.95	0.91
T1 Parent	0.89	0.84	0.86	0.90	0.79
T2 Teacher	0.97	0.89	0.92	0.96	0.90
T2 Parent	0.95	0.85	0.86	0.89	0.86

The BRIEF-P negativity subscale was computed for parents and teachers at both time points of this study in order to assess whether respondents approached the measure in "an unusually negative manner" (Gioia et al., 2003, p. 16). At Time 1, mean negativity scores were 0.27 (*SD* = 0.87) for parents and 0.55 (*SD* = 1.25) for teachers. At Time 2, means on this scale were 0.20 (*SD* = 0.65) for parents and 0.00 (*SD* = 0.00) for teachers. All of these means are within the "acceptable" range (i.e., less than 3; Gioia et al., 2003). The BRIEF-P inconsistency index was also calculated in order to assess whether respondents provided consistent ratings on similar (paired) items. At Time 1, the mean inconsistency score was 4.64 (*SD* = 2.33) for parents and 4.08 for teachers (*SD* = 2.88). At Time 2, means on this scale were 4.61 (*SD* = 2.32) for parents and 4.60 (*SD* = 2.56) for teachers. All of these inconsistency scale means are within the "acceptable" range (i.e., less than 7) according to Gioia and colleagues (2003).

Receptive vocabulary. The Receptive Vocabulary subtest of Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III; Wechsler, 2002) was used to assess receptive vocabulary. For this subtest, children are shown a book with pictures of various stimuli and asked to point to particular objects (e.g., a butterfly or a giraffe). Total scores are computed by summing the number of correct responses provided by the child, with higher scores on this measure representing better receptive vocabulary. The WPPSI-III was standardized with a representative sample of 700 Canadian English-speaking children ranging from 2 years, 6 months to 7 years, 3 months of age (Wechsler, 2002). This standardization sample was divided into nine groups. The first six groups each spanned 5 month age intervals and consisted of 80 children. A seventh group of 100 children ranged in age from 6 years to 6 years, 11 months; an eighth group of 40 children ranged in age from 7 years to 7 years, 3 months. On average, the internal consistency of the Receptive Vocabulary subtest was found to be good, $r = 0.85$, across

all of the nine age groups in the standardization sample. The test-retest reliability of the Receptive Vocabulary subtest was 0.77 (corrected $r = 0.82$; Wechsler, 2002). According to Wechsler (2002), the Receptive Vocabulary subtest was shown to correlate positively ($r = 0.59$) with the Mental Composite Score (which evaluates language skills, as well as several other factors, including: sensory/perceptual abilities, memory, problem-solving, mental mapping, and understanding of mathematical concepts) of the Bayley Scales of Infant Development – Second Edition (BSID-II).

Expressive vocabulary. In order to gauge expressive vocabulary, children were administered the Picture Naming subtest of the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III; Wechsler, 2002). The Picture Naming subtest involves a stimulus book that contains pictures which children are asked to label. The examiner points to a picture and asks the child "What is this?". As with receptive vocabulary, total scores of expressive vocabulary are computed by summing the number of appropriate responses provided by the child. Higher scores on this measure are indicative of better expressive vocabulary. In the Canadian standardization sample of the WPPSI-III, the Picture Naming subtest was shown to have satisfactory internal consistency across all of the age groups (mean alpha = 0.87). The test-retest reliability of the Picture Naming subtest was also found to be good, $r = 0.85$ (corrected $r = 0.87$). As evidence of external validity, Picture Naming Scores were shown to correlate ($r = 0.68$) with the Mental Composite Score of the BSID-II. Moreover, scores on the Picture naming subtest have been found to correlate with Receptive Vocabulary scores as well ($r = 0.62$; Wechsler, 2002).

Study 1 Results

Data Cleaning & Analyses

Prior to any of the analyses being conducted, the data was screened and, in some cases, variables were transformed and outliers were deleted. At both time points, inverse transformations were made to all BRIEF-P and CBS physical aggression data. Consequently, correlation results are to be interpreted accordingly. Specifically, following transformation, lower scores on all CBS physical aggression scales (teacher and parent) reflected more physical aggression. Lower scores on the BRIEF-P were indicative of poorer executive function.

Study 1 included hypotheses about whether vocabulary (receptive and expressive) and executive functioning are predictive of physical aggression (criterion). Accordingly, preliminary analyses were conducted to examine the inter-correlations of all predictors with the criterion. Questions about the cumulative and relative contributions of these predictors in explaining variance in physical aggression were examined using a series of multiple regressions for Time 1 and Time 2 separately. In addition, two other hierarchical regression analyses were conducted to explore whether executive functioning and language at Time 1 would be predictive of physical aggression at Time 2 after controlling for Time 1 physical aggression.

Descriptive Results

Physical aggression was rated by parents (Time 1 and Time 2) and teachers (Time 1) with scores represented as an average of three items (i.e., “kicks, bites, hits”, “gets into many fights”, “physically attacks”) ranging from a low of 0 to a high of 2. The mean for parent-rated physical aggression at Time 1 was 0.55 (*SD* = 0.48) for boys and 0.33 (*SD* = 0.43) for girls. Consistent with previous research (e.g., Cote et al., 2006; Baillargeon et al., 2007), this difference was found to be significant, as boys were reported by their parents to show more physical aggression

than girls, t (319) = -4.39, $p < 0.001$. The overall mean for parent-rated physical aggression at Time 1was 0.44 (*SD* = 0.47). The mean for teacher-rated physical aggression was 0.61 (*SD* = 0.61) for boys and 0.32 (*SD* = 0.51) for girls. Once again, this gender difference was significant, t (399) = -5.09, $p < 0.001$. The total mean was 0.47 (*SD* = 0.59). At Time 2, the mean of parent-rated physical aggression was 0.46 (*SD* = 0.44) for boys and 0.25 (*SD* = 0.47) for girls. There was only a marginally significant gender difference in physical aggression at Time 2, t (69) = -1.915, $p = 0.06$. The overall mean at Time 2 was 0.35 (*SD* = 0.46). The results of a paired-samples t-tests showed that mean physical aggression scores at Time 1 and Time 2 were not significantly different on the parent CBS measure for girls, t (34) = 1.18, $p = 0.25$, boys, t (33) = 0.76, $p = 0.45$ or overall, t (68) = 1.37, $p = 0.17$.

While average CBS scores were used in all of the subsequent analysis, in order to compare this sample to the 1994-1995 National Longitudinal Survey of Children and Youth (NLCSY) sample which involved children age 0-11 in each of the 10 Canadian provinces, responses from the CBS in the current study were also summed. In the current sample, average summed scores for girls were 0.98 (*SD* =1.30), 0.96 (*SD* = 1.53), and 0.75 (*SD* = 1.40) on the Time 1 parent CBS, Time 1 teacher CBS and Time 2 parent CBS measures, respectively. For boys, average summed scores were 1.66 (*SD* = 1.45) on the parent CBS measure at Time 1, 1.82 (*SD* = 1.84) on the Teacher CBS measure at Time 1, and 1.37 (*SD* = 1.33) on the parent CBS measure at Time 2. Comparatively, the NLSCY results showed mean scores on this same measure ranging from 0.77 (*SD* = 0.98) to 1.17 (*SD* = 1.21) among Canadian girls from 2-6 years and ranging from 1.02 (*SD* = 1.22) to 1.52 (*SD* = 1.23) for boys aged 2-6 years (Cote et al., 2006). This suggests that boys in the current sample were slightly more aggressive than the

national average (in 2006), while girls in this sample demonstrated relatively typical levels of aggression.

Physical aggression data was found to be significantly positively skewed in the current sample, with a larger proportion of children being reported to show low levels of physical aggression according to parent and teacher ratings. In order to obtain a more normal distribution in the current study, inverse transformations were conducted for all of the average scores for physical aggression. Accordingly, average scores of physical aggression ranged from 0.33-1.00 for each of the three variables. Following these transformations, at Time 1 the mean for parent-rated physical aggression became 0.76 (*SD* = 0.22), and the mean reported by daycare teachers became 0.77 (*SD* = 0.24). Parent and teacher ratings were significantly correlated, r (319) = 0.31, $p < 0.01$. At Time 2, the mean for CBS parent-rated physical aggression was 0.80 (*SD* = 0.21) following the inverse transformation. Time 2 physical aggression scores correlated significantly with both Time 1 parent r (69) = 0.51, $p < 0.01$, and teacher ratings, r (69) = 0.38, $p < 0.01$. No significant relationships between average physical aggression scores and age emerged (see Table 2).

All of the BRIEF-P normative sample means for the five subscales of executive function were within one standard deviation of the current sample means (Gioia et al., 2003). This suggests that executive skills in this sample are comparable to a wider population of similar-aged children (see Table 2).

Vocabulary scores in this sample were likewise comparable to the general population. Although raw scores were used in the analyses, WPPSI scaled scores can be employed for comparability purposes. WPPSI scaled scores have a mean of 10 and a standard deviation of 3. In the current sample, mean scaled scores for receptive vocabulary were 9.92 (*SD* = 3.21) at

Table 2

BRIEF-P Raw Score Means and Standard Deviations

Measure	T1 Teacher	T1 Parent	T2 Teacher	T2 Parent
Inhibit	23.43	24.48	26.16	25.08
(*SD*)	(7.88)	(5.89)	(9.45)	(7.50)
Shift	13.34	14.44	14.50	14.62
(SD)	(3.94)	(3.96)	(4.33)	(3.78)
Emotional	14.21	15.48	15.83	15.75
Control *(SD)*	(4.89)	(3.85)	(5.21)	(4.01)
Working Memory	24.01	23.45	24.62	23.90
(SD)	(7.86)	(5.75)	(7.94)	(5.50)
Plan/Organize	14.54	14.60	14.99	15.32
(SD)	(4.54)	(3.14)	(4.33)	(3.69)
N	399	334	76	73

Time 1 and 11.00 (*SD* = 2.66) at Time 2. Mean scaled scores for expressive vocabulary were 9.89 (*SD* = 3.51) at Time 1 and 10.87 (*SD* = 2.37) at Time 2.

Correlation Results

Hypothesis 1. It was predicted that better expressive vocabulary skills would be associated with lower physical aggression. At Time 1, both parent and teacher reports of physical aggression were found to be positively correlated with expressive vocabulary (see Table 3). Given that the physical aggression variables were inversely transformed, these positive correlations indicate that better expressive vocabulary was associated with lower physical aggression reported by both parents and teachers. At Time 2, parent-reported physical aggression was not significantly correlated with expressive vocabulary although the magnitude of this correlation was close to that observed at Time 1. In order to have had sufficient power (i.e., power = 0.80) to detect a significant relationship of this magnitude between expressive vocabulary and physical aggression, there would have needed to be 480 participants at Time 2. The actual observed power for this correlational analysis at Time 2 was 0.24.

Finally, going across time, Time 1 expressive vocabulary did not correlate significantly with Time 2 parent-reported physical aggression. As mentioned above, teachers did not complete the CBS questionnaire on aggression at Time 2.

Hypothesis 2. It was predicted that better receptive vocabulary skills would be associated with lower physical aggression. At Time 1, receptive vocabulary was positively correlated with teacher-reported physical aggression (see Table 3). Given the data transformations, this correlation suggests that better understanding of spoken language went along with lower physical aggression. No significant relationships were found between receptive vocabulary and parent-reported physical aggression at Time 1 or between receptive vocabulary and parent-reported

Table 3

Bivariate Zero-Order One-Tailed Correlations Between Time 1 & 2 Variables & Physical Aggression

Measure	T1 Teacher Aggression	T1 Parent Aggression	T2 Parent Aggression
T1 Age	0.06	0.03	0.00
T1 Receptive	**0.11***	0.09	0.04
T1 Expressive	**0.14****	**0.12***	0.21
T1 Teacher Inhibit	**0.66****	**0.26****	**0.45****
T1 Teacher Shift	**0.15****	0.07	0.01
T1 Teacher EC	**0.48****	**0.25****	**0.23***
T1 Teacher WM	**0.45****	**0.23****	**0.35****
T1 Teacher PO	**0.43****	**0.19****	**0.25***
T1 Parent Inhibit	**0.25****	**0.35****	**0.47****
T1 Parent Shift	-0.04	**0.17****	**0.20****
T1 Parent EC	0.03	**0.32****	**0.41****
T1 Parent WM	**0.12***	**0.29****	**0.24****
T1 Parent PO	**0.10***	**0.26****	**0.42****
T2 Age	-0.05	-0.02	0.02
T2 Receptive	0.09	**0.25****	0.10
T2 Expressive	0.12	**0.19***	0.13
T2 Teacher Inhibit	**0.47****	**0.41****	**0.46****
T2 Teacher Shift	0.14	**0.28****	0.03
T2 Teacher EC	**0.39****	**0.29****	0.05
T2 Teacher WM	**0.27***	**0.27***	**0.25***
T2 Teacher PO	**0.34****	**0.30****	**0.25***
T2 Parent Inhibit	**0.29****	**0.30****	**0.50****
T2 Parent Shift	-0.13	0.17	**0.22****
T2 Parent EC	0.04	**0.26***	**0.38***

Table 3 (con't)

Measure	T1 Teacher Aggression	T1 Parent Aggression	T2 Parent Aggression
T2 Parent WM	**0.27***	**0.33****	**0.44****
T2 Parent PO	0.08	**0.33****	**0.35****
Mean	0.77	0.76	0.80
SD	0.24	0.22	0.21
N	401	321	71

Note: All significant correlations are in bold and are marked by asterisks.
df = 69-399; * = $p < .05$, ** = $p < .01$.

physical aggression at Time 2. This latter finding likely reflected a lack of power, however, considering that the magnitude of this correlation was comparable to the magnitude of the association between teacher-rated physical aggression and language competencies at Time 1 (which was found to be significant). In order to have had the statistical power (i.e., power = 0.80) to detect a significant correlation of this magnitude between receptive vocabulary and physical aggression, there would have needed to be 740 participants at Time 2. The actual value of power for this analysis was less than 0.17.

Hypothesis 3. A series of correlation analyses were conducted in order to test the hypothesis that higher levels of executive dysfunction according to the BRIEF-P would be associated with higher levels of physical aggression (see Table 3). Of particular interest was whether and to what extent different domains of executive function were differentially related to physical aggression. It was expected that inhibition skills would be particularly connected to physical aggression scores. Correlations were conducted both across raters and within the same rater. Correlational analyses that employ reports from different raters help eliminate the confounding effects of shared method variance.

Looking across raters, Time 1 correlations revealed that *teacher reports* of Inhibition, Emotional Control (EC), Working Memory (WM) and Planning/Organization (PO) were all positively correlated with *parent-reported* scores of physical aggression at Time 1 although teacher-reports of children's capacity to Shift attention was not. An examination of these correlations, factoring in the data transformations suggests that in all cases better executive function skills (inhibition, emotional control, working memory, planning/organization) reported by teachers went along with less physical aggression seen by parents. Similarly, *parent reports* of Inhibition, Working Memory (WM), and Planning/Organization (PO) were significantly

positively correlated with teacher reports of physical aggression, once again suggesting that better parent-reported executive function skills in each of these three domains is associated with less physical aggression as seen by teachers.

Also at Time 1, looking within raters, all five of the *parent-reported* BRIEF-P subscales were found to be significant and positively correlated with *parent reports* of physical aggression. Similarly, all five of the Time 1 *teacher-reported* executive function subscales were positively correlated with Time 1 *teacher reports* of physical aggression. This provides consistent evidence that greater physical aggression at this age was tied to more poorly developed executive function skills.

At Time 2, looking across raters, the teacher-reported Inhibit subscale of the BRIEF-P correlated positively with parent-reported physical aggression. This correlation serves as further evidence that better executive functioning was observed to go along with less reported physical aggression. In addition, for the within-rater associations at Time 2, all five of the parent-reported subscales of the BRIEF-P executive function measure were once again significantly and positively correlated with parent-reported aggression. These correlations indicated that, for parent reports, better executive functioning was observed to go along with less observed physical aggression at Time 2. Within-rater correlations were not possible for teacher-reports at Time 2 because information on physical aggression was not collected from teachers at that time.

Regression Results (Hypotheses 1-3)

Variable selection. Prior to conducting the multiple regressions, a decision was made to remove Working Memory and Planning/Organizing from all of the regression analyses, as these two variables were highly correlated with other measures of executive function, as rated by

parents and teachers, at both Time 1 and Time 2 (see Tables 4-5). The decision to exclude Working Memory and Planning/Organizing from the regression analyses allowed for a more parsimonious interpretation of results, minimized the possibility of suppression in regressions, and minimized multicollinearity.

Following the variable reductions, regression analyses were conducted including Inhibition, Shift and Emotional Control as indices of executive function. Notably, inhibition seemed to be the aspect of executive functioning that was most often uniquely predictive of physical aggression. However, several of these regression equations were found to contain suppressor variables.

In order to eliminate suppression, the number of predictor variables had to be reduced. Accordingly, a series of three regression analyses were conducted to assess which of the executive function variables to include amongst the primary regressions aimed at assessing the relative and cumulative contributions of vocabulary and executive function in the prediction of physical aggression. In the first regression equation, Time 1 parent-reported physical aggression served as the criterion variable, and Time 1 parent-reported Inhibition, Shift and Emotional Control skills were entered as predictor variables. Both Inhibition, $\beta = 5.51$, t (312) = 3.86, $p <$ 0.001 and Emotional Control $\beta = 2.74$, t (312) = 2.82, $p = 0.005$ emerged as being uniquely predictive of physical aggression while Shift produced a non-significant negative Beta value, $\beta =$ -0.52, t (312) = -0.65, $p = 0.51$.

In the second regression, Time 1 teacher-reported physical aggression served as the criterion variable and teacher-reported Inhibition, Shift and Emotional Control skills were entered as predictor variables. In this case, all three variables emerged as uniquely predictive, with Inhibition, $\beta = 11.01$, t (385) = 12.58, $p < 0.001$ and Emotional Control, $\beta = 3.71$, t (385) =

Table 4

Bivariate Zero-Order Correlations Between T1 Teacher BRIEF - P Subscales

Measure	T1 Teacher Inhibit	T1 Teacher Shift	T1 Teacher Emotional Control	T1 Teacher Working Memory	T1 Teacher Planning/ Organizing
T1 Teacher Inhibit		**0.39****	**0.61****	**0.80****	**0.75****
T1 Teacher Shift			**0.65****	**0.50****	**0.50****
T1 Teacher EC				**0.55****	**0.52****
T1 Teacher WM					**0.90****
T1 Teacher P/O					
N	399	398	399	397	399

Note: All significant correlations are in bold and are marked by asterisks.
df = 395-397; * = $p < .05$, ** = $p < .01$

Table 5

Bivariate Zero-Order Correlations Between T1 Parent BRIEF - P Subscales

Measure	T1 Parent Inhibit	T1 Parent Shift	T1 Parent Emotional Control	T1 Parent Working Memory	T1 Parent Planning/ Organizing
T1 Parent Inhibit		**0.35****	**0.55****	**0.72 ****	**0.66****
T1 Parent Shift			**0.55****	**0.40****	**0.36****
T1 Parent EC				**0.46****	**0.46****
T1 Parent WM					**0.78****
T1 Parent P/O					
N	332	334	334	332	331

Note: All significant correlations are in bold and are marked by asterisks.
* = $p < .05$, ** = $p < .01$.

5.69, $p < 0.001$ having positive Beta values and Shift, $\beta = -3.76$, t (385) = -5.88, $p < 0.001$ having a negative Beta value, indicating suppression. Lastly, when Time 2 parent-reported physical aggression scores served as the criterion and Time 2 parent reports of Inhibition, Shift and Emotional Control skills served as predictor variables, only Inhibition skills emerged as uniquely predictive of physical aggression, $\beta = 8.49$, t (65) = 3.23, $p = 0.002$. Both Emotional Control, $\beta = 2.22$, t (65) = 1.12, $p = 0.268$ and Shift, $\beta = -1.33$, t (65) = 0.78, $p = 0.44$ were not uniquely predictive of Time 2 physical aggression. Taken together, these three regression analyses seem to suggest that inhibition skills were more consistently statistically relevant to the prediction of physical aggression than either of the other two executive function scales.

Further exploratory correlation and regression analyses were then conducted with the Inhibitory Self-Control Index (ISCI). This score is a composite of both the Inhibit and Emotional Control subscales. On average, ISCI scores were not found to be any more related to or predictive of physical aggression than was inhibition alone.

On the basis of these results, and because inhibition was expected to be particularly relevant to physical aggression for theoretical reasons, inhibition was selected as the only BRIEF-P scale to be included in each of the following regression analyses. This allowed for a standard set of predictors to be used in each of the following regression analyses, while also simplifying the interpretation of results. This did amount to some loss of variance accounted for in physical aggression, however, this loss was relatively minimal in most cases, and the pattern of results remained the same (although less complex) without the inclusion of Shift and Emotional Control as additional predictor variables.

Despite the correlations between receptive and expressive vocabulary at both Time 1, r (403) = 0.73, $p < 0.001$ and Time 2, r (91) = 0.60, $p < 0.001$, the inclusion of both of these

variables in the regression analyses did not yield significant problems with multicollinearity. Given that it was of interest to assess the relative predictive value for each of these two scales, both were included as separate measures in the following regression analyses.

A series of twelve hierarchical regression analyses were conducted in order to examine the relative and cumulative contributions of expressive vocabulary, receptive vocabulary and executive function (i.e., inhibition) in the prediction of physical aggression. Although relevant statistical values are presented in the text of the results, interested readers are directed to Appendix E for a comprehensive table with all values obtained for these regressions.

The 12 regressions were conducted concurrently for Time 1 (eight regressions) and for Time 2 (four regressions) data. Regressions in this series are reported below in pairs. Specifically, a hierarchical regression where vocabulary (Receptive and Expressive) is entered on Step 1 and inhibition on Step 2 is matched with a hierarchical regression where Inhibition is entered on Step 1 with the vocabulary measures on Step 2. The overall R^2 (following Step 2) for both of these regressions is identical and provides an estimate of the cumulative effect of vocabulary and Inhibition. The changes (from Step 1 to Step 2) for each regression in a pair provide information on the relative effects of vocabulary and Inhibition by giving an R^2 change from the first to the second step. Given that there are multiple indicators within the vocabulary block, individual beta weights are also presented and interpreted for each pair of regressions. Two hierarchical regressions were also conducted to look at longitudinal predictors with parent-rated aggression at Time 2 serving as the criterion variable.

Time 1 parent reported physical aggression predicted by language and parent reports of Inhibition. In this first pair of regressions, physical aggression at Time 1 (parent-reported) was predicted from parent-reported Inhibition and the two indices of vocabulary

ability. Accordingly, in the first regression equation, Time 1 parent-reported physical aggression served as the criterion variable, Time 1 Receptive and Expressive Vocabulary were entered on Step 1, and Time 1 Parent Inhibit, was entered on Step 2. Receptive and Expressive Vocabulary were not found to significantly predict physical aggression, $R^2 = 0.02$, F (2, 302) = 2.32, p = 0.10. However, the addition of Inhibition did add a significant amount of variance in predicting physical aggression, over and above that accounted for by vocabulary, R^2-*Change* = 0.12, *F-Change* (1, 301) = 36.58, $p < 0.001$. When all variables were in the equation, $R^2 = 0.12$, F (3, 301) = 13.92, $p < 0.001$, providing an estimate of the cumulative effect of parent reported executive functioning along with language measures on physical aggression.

In a second regression equation, Time 1 parent-reported physical aggression served as the criterion variable, with the blocks of predictors reversed so that Time 1 Parent Inhibit, was entered on Step 1 and Time 1 Receptive and Expressive Vocabulary were entered on Step 2. By itself, Inhibition was found to significantly predict physical aggression, $R^2 = 0.12$, F (1, 303) = 39.65, $p < 0.001$. The vocabulary indices were not found to predict a significant amount of variance in physical aggression, over and above that accounted for by executive function R^2-*Change* = 0.006, *F-Change* (2, 301) = 1.05, p = 0.35.

In each of these two analyses, Inhibit, $\beta = 0.33$, t (302) = 6.05, $p < 0.001$ was the only variable that emerged as being uniquely predictive of physical aggression when all variables were in the equation. Once again, this suggests that more physical aggression, as reported by parents at Time 1, could be predicted from poorer inhibition skills, as reported by parents.

Time 1 teacher reported physical aggression predicted by language and teacher reports of Inhibition. In the second pair of regressions, teacher reports of physical aggression were given consideration. Thus, in a third regression equation, Time 1 teacher-reported physical

aggression served as the criterion variable, Time 1 Receptive and Expressive Vocabulary were entered on Step 1, and Time 1 Teacher Inhibit was entered on Step 2. This time, Receptive and Expressive Vocabulary significantly predicted physical aggression, $R^2 = 0.02$, F (2, 373) = 3.47, $p = 0.03$. Moreover, in Step 2 Inhibition accounted for a significant amount of variance in physical aggression, over and above that accounted for by vocabulary, R^2-*Change* = 0.42, *F-Change* (1,372) = 279.47, $p < 0.001$. The cumulative effect of teacher reported Inhibition along with language measures on teacher-rated physical aggression was estimated when all of these variables were included in the regression equation, $R^2 = 0.44$, F (3, 372) = 97.19, $p < 0.001$.

In a fourth regression equation the ordering of language and executive functioning were reversed. Time 1 teacher-reported physical aggression served as the criterion variable, Time 1 Teacher reports of Inhibition were entered on Step 1 and Time 1 Receptive and Expressive Vocabulary were entered on Step 2. Teacher Inhibition scores alone were found to significantly predict physical aggression, $R^2 = 0.44$, F (1, 374) = 290.65, $p < 0.001$. Indices of vocabulary added on Step 2 were not found to predict a significant amount of variance in physical aggression, over and above that accounted for by Inhibition skills, R^2-*Change* = 0.002, *F-Change* (2, 372) = 0.70, $p = 0.50$.

In each of these two analyses, Inhibit, $\beta = 0.66$, t (373) = 16.72, $p < 0.001$ emerged as being uniquely predictive of physical aggression when beta weights were evaluated on Step 2 with all predictors in the equation. Again, this means that more physical aggression, as reported by teachers, could be predicted from poorer inhibition capabilities as reported by teachers.

Time 1 parent-reported physical aggression predicted by language and teacher reports of Inhibition. In this model, Time 1 parent-reported physical aggression served as the criterion variable, Time 1 Receptive and Expressive Vocabulary were entered on Step 1, and

Time 1 Teacher Inhibit, was entered on Step 2. By using this order, it was possible to prioritize the language predictors and then examine the change in R^2 when Inhibition was added. Together, Receptive and Expressive Vocabulary were not found to significantly predict physical aggression, R^2=0.02, F (2,298)=2.47, p=0.09. However, the addition of Inhibition did account for a significant amount of variance in physical aggression, over and above that accounted for by vocabulary, R^2-*Change* = 0.06, *F-Change* (1, 297) = 17.76, $p < 0.001$. It is also important to note that the overall R^2 was 0.07 with F (3, 297) = 7.66, $p < 0.001$, providing an assessment of the cumulative effect of language and Time 1 teacher-reported inhibition skills in predicting Time 1 parent-reported physical aggression.

In the second regression equation of this pair, the hierarchical entry of vocabulary and executive functioning were reversed. Time 1 parent-reported physical aggression served as the criterion variable, Time 1 Teacher Inhibit, was entered on Step 1 and Time 1 Receptive and Expressive Vocabulary were entered on Step 2. In Step 1, Inhibition by itself was found to significantly predict physical aggression, R^2 = 0.06, F (1,299) = 20.59, $p < 0.001$. Vocabulary indices were not found to predict a significant increment in variance accounted for in physical aggression, over and above the presence of teacher-reported Inhibition skills, R^2-*Change* = 0.01, *F-Change* (2, 297) = 1.18, p = 0.31.

In each of these two analyses when all variables were in the equation, Inhibition, β = 0.24, t (298) = 4.21, $p < 0.001$, emerged as being uniquely predictive. This means that more physical aggression, as reported by parents, could be predicted from poorer inhibition skills, as reported by teachers.

Time 1 teacher reported physical aggression predicted by language and parent reports of Inhibition. In the fourth and final pair of regressions conducted to look at patterns of

relationships at Time 1, teacher-reported physical aggression was predicted by parent reports of Inhibition alongside language. In a seventh regression equation, Time 1 teacher-reported physical aggression served as the criterion variable, Time 1 Receptive and Expressive Vocabulary were entered on Step 1, and Time 1 Parent Inhibition was entered on Step 2. Once again, Receptive and Expressive Vocabulary significantly predicted physical aggression, R^2 = 0.02, F (2, 305) = 3.41, p = 0.03, and in Step 2, parent-reported Inhibition also accounted for a significant amount of variance in physical aggression, over and above that accounted for by vocabulary, R^2-*Change* = 0.06, *F-Change* (1, 304) = 20.02, $p < 0.001$. When all variables were in the equation, R^2 = 0.08, F (3, 304) = 9.09, $p < 0.001$. This provides an estimate of the cumulative effect of parent reported Inhibition along with language measures on teacher ratings of physical aggression.

In an eighth regression equation, the hierarchy of predictors was reversed. Time 1 teacher-reported physical aggression was the criterion variable, Time 1 Parent Inhibit was entered on Step 1 and Time 1 Receptive and Expressive Vocabulary were entered on Step 2. Parent-reported Inhibition was found to significantly predict physical aggression, R^2 = 0.07, F (1, 306) = 22.53, $p < 0.001$. Vocabulary was not found to predict a significant amount of variance in teacher-rated physical aggression, over and above that accounted for by executive function R^2-*Change* = 0.01, *F-Change* (2, 302) = 2.28, p = 0.10.

When all predictors were in the equation, the only significant independent predictor was Inhibition, β = 0.25, t (305) = 4.48, $p < 0.001$. This suggests that more teacher-reported aggression is predicted by poorer inhibition skills, as reported by parents.

Time 2 parent reported physical aggression predicted by Time 2 language and parent reports of Inhibition. In the first pair of hierarchical regressions conducted on Time 2

data, the ninth regression equation included Time 2 parent-reported physical aggression served as the criterion variable, Time 2 Receptive and Expressive Vocabulary were entered on Step 1, and Time 2 Parent Inhibition skills were entered on Step 2. Together, Receptive and Expressive Vocabulary were not found to significantly predict physical aggression, $R^2 = 0.01$, F (2, 59) = 0.25, $p = 0.78$. However, parent reports of Inhibition skills did account for a significant amount of variance in physical aggression, over and above that accounted for by vocabulary, R^2-*Change* = 0.34, *F- Change* (1, 58) = 30.47, $p < 0.001$. Overall, when all of the variables from Step 2 were included in the equation, $R^2 = 0.35$, F (3, 58) = 10.40, $p < 0.001$, providing information on the cumulative effect of vocabulary and parent-reported Inhibition skills in the prediction of Time 2 parent ratings of physical aggression.

In a tenth regression equation, the order of entry for parent reports and vocabulary were reversed. Time 2 parent-reported physical aggression served as the criterion variable, Time 2 Parent Inhibit was entered on Step 1 and Time 2 Receptive and Expressive Vocabulary were entered on Step 2. The executive function variable was found to significantly predict physical aggression, $R^2 = 0.31$, F (1, 60) = 27.50, $p < 0.001$. Vocabulary was not found to predict a significant amount of variance in physical aggression, over and above that accounted for by Inhibition, R^2-*Change* = 0.04, *F Change* (2, 58) = 1.59, $p = 0.21$.

Consistent with Time 1 patterns of data, the only independent predictor in either of these Time 2 regression equations was Parent Inhibition skills, $\beta = 0.60$, t (59) = 5.52, $p < 0.001$. This provides some converging evidence that physical aggression (reported by parents) is greater when young children are viewed by parents to have difficulty inhibiting their behaviour.

Time 2 parent reported physical aggression predicted by Time 2 language and teacher reports of Inhibition. In an eleventh regression equation, parent-reported physical

aggression as the criterion variable with Time 2 Receptive and Expressive Vocabulary entered on Step 1, while Time 2 Teacher Inhibit was entered on Step 2. At Time 2, Receptive and Expressive Vocabulary were not found to significantly predict physical aggression, $R^2 = 0.01$, F (2, 48) = 0.31, $p = 0.74$. However, Inhibition did account for a significant amount of variance in physical aggression, over and above that accounted for by vocabulary, R^2-*Change* = 0.23, *F-Change* (1, 47) = 14.02, $p < 0.001$. The overall $R^2 = 0.24$ after Step 2 was entered into the equation, F (3, 47) = 4.93, $p = 0.005$, providing information on the cumulative effect of vocabulary and teacher-reported executive functioning in the prediction of physical aggression and Time 2.

In the twelfth and final regression equation in this series, the order of block entry was reversed with Time 2 parent-reported physical aggression continuing to serve as the criterion variable, Time 2 Teacher Inhibit entered on Step 1, and Time 2 Receptive and Expressive Vocabulary were entered on Step 2. Inhibition was found to significantly predict physical aggression, $R^2 = 0.23$, F (1, 49) = 14.89, $p < 0.001$. Vocabulary was not found to predict a significant amount of variance in physical aggression, over and above that accounted for by the executive function subscale of inhibition, R^2-*Change* = 0.01, *F- Change* (3, 47) = 0.20, $p = 0.82$.

Once again, Inhibition skills were the only significant independent predictor, $\beta = 0.49$, t (48) = 3.74, $p < 0.001$. This finding suggests that more parent-reported aggression is predicted by poorer teacher-reported inhibition skills at Time 2.

Time 2 physical aggression predicted by Time 1 Inhibition and language skills. Finally, in order to examine the prediction of change in physical aggression over time, two hierarchical regression analyses were conducted to explore whether Inhibition and language skills at Time 1 would predict physical aggression at Time 2 after controlling for Time 1 physical

aggression. In the first regression equation, Time 2 parent-reported physical aggression was the criterion variable, and Time 1 physical aggression scores were entered on Step 1. Step 2 included receptive vocabulary, expressive vocabulary and teacher reports of Inhibition skills at Time 1. The results of this analysis suggested that Time 1 parent-reported physical aggression was significantly predictive of Time 2 parent reports of physical aggression, $R^2 = 0.27$, F (1, 65) = 23.74, $p < 0.001$. Moreover, language and teacher-rated inhibition skills (entered on Step 2) predicted Time 2 aggression scores at a statistically significant level over and above the effect of Time 1 physical aggression scores, R^2-*Change* = 0.12, *F- Change* (3, 62) = 4.13, $p = 0.01$. Teacher reports of Inhibition was the only variable entered on Step 2 that was found to be a significant independent predictor of Time 2 physical aggression scores, $\beta = 0.34$, t (64) = 3.30, $p = 0.002$, suggesting that higher levels of aggression are predicted by greater difficulties with inhibition across time. In other words, difficulties with inhibition can predict higher levels of aggression a year after inhibition skills were assessed even when pre-existing levels of physical aggression are controlled.

In the second regression equation, Time 2 parent reported physical aggression was once again the criterion variable, and Time 1 physical aggression scores were entered on Step 1. Step 2 of this analysis included Time 1 receptive and expressive vocabulary, and parent reports of Inhibition skills. Once again, Time 1 parent reported aggression significantly predicted Time 2 parent reported aggression scores, $R^2 = 0.28$, F (1, 66) = 24.97, $p < 0.001$. In this equation, Time 1 receptive and expressive vocabulary and parent reports of Inhibition skills were once again also significantly predictive of Time 2 physical aggression scores over and above the effect of Time 1 physical aggression scores, R^2-*Change* = 0.10, *F Change* (3, 63) = 3.56, $p = 0.02$. Among the variables entered on Step 2, parent-reported Inhibition was once more the only significant

independent predictor of Time 2 parent-rated physical aggression scores, $\beta = 0.33$, $t\ (65) = 3.04$, $p = 0.003$ suggesting that higher levels of aggression at Time 2 are predicted by previous difficulties with inhibition (as assessed at Time 1) after controlling for earlier physical aggression.

Change Over Time

In order to assess whether decreases in physical aggression over time were associated with increases in receptive and/or expressive vocabulary skills over time, differences scores were calculated. For physical aggression, parent reports of physical aggression at Time 1 were subtracted from parent reports of physical aggression at Time 2. Similarly, for both receptive and expressive vocabulary, scores at Time 1 were subtracted from scores at Time 2. Subsequently, difference scores for physical aggression (where negative scores indicate a reduction in physical aggression) were correlated with difference scores for receptive vocabulary and with difference scores for expressive vocabulary (where positive scores represent an increase in competency). These correlation analyses revealed no significant findings (see Table 6).

Difference scores were also calculated for each of the five BRIEF-P parent subscales, and for each of the five BRIEF-P teacher subscales. In order to assess whether decreases in physical aggression over time were associated with increases in executive function skills over time, the ten executive function subscale difference scores were correlated with the difference scores for physical aggression. One-tailed correlation analyses were conducted. Taking the transformations into account, significant positive correlation coefficients here suggest that that decreases in physical aggression over time were associated with decreased difficulties with Inhibition, Emotional Control and Working Memory skills as reported by parents (see Table 6).

Table 6

Bivariate Zero-Order One-Tailed Correlations Between Difference Scores

Measure	Physical Aggression T2-T1
Receptive T2-T1	0.13
Expressive T2-T1	0.05
Parent Inhibit T2-T1	**0.22***
Parent Shift T2-T1	0.02
Parent EC T2-T1	**0.20***
Parent WM T2-T1	**0.25***
Parent PO T2-T1	0.08
Teacher Inhibit T2-T1	-0.04
Teacher Shift T2-T1	-0.22
Teacher EC T2-T1	-0.24
Teacher WM T2-T1	-0.07
Teacher PO T2-T1	-0.03
Mean	-0.07
SD	0.44
N	69

Note: All significant correlations are in bold and are marked by asterisks.
* = $p < .05$, ** = $p < .01$

Study 1 Discussion

A brief discussion of the results from Study 1 will now be provided with a more extensive discussion of implications for these findings presented following Study 2 in the General Discussion. The goal of Study 1 was to examine the complex relationships between executive function and physical aggression, and between vocabulary and physical aggression among a sample of children whose mean age (42 months) was outside the proposed sensitive period for learning to inhibit physically aggressive behaviour. Table 7 provides a summary of Study 1 findings with specific reference to whether hypotheses were supported or not.

Measure of Physical Aggression (CBS)

A longitudinal examination of the data revealed that there was very little change in physical aggression scores over the two time points in Study 1. This finding is somewhat surprising, given that most research in the area would suggest a typical decline in physical aggression during this time of development (Arsenio, 2004a; Cote et al., 2007; Cote et al., 2006; Gauthier, 2003; Tremblay, 2000; Tremblay, 2001). However, the way in which physical aggression was measured in Study 1 required parents and teachers to rate physically aggressive behaviour as occurring either "never", "sometimes", or "often". Categorizing aggression in this way may have been too subjective, in that it relied heavily on the rater to define what "never", "sometimes", or "often" meant to them. Accordingly, participants' definition of "never", "sometimes", and "often" for a particular child may have changed over the course of the year, coinciding with developmentally appropriate expectations for this behaviour. Similarly, this type of scale restricts the amount of variability in responses. Either a greater number of options or an open-ended response scale asking participants to report the actual

Table 7

Summary of Study 1 Findings

Hypotheses	**Findings**
1. Better expressive vocabulary will be associated with and predictive of lower physical aggression (concurrently).	**Hypothesis was partially supported.**
2. Better receptive vocabulary will be associated with and predictive of lower physical aggression (concurrently).	**Hypothesis was partially supported.**
3. Greater levels of executive dysfunction will be associated with and predictive of higher levels of physical aggression (concurrently).	**Hypothesis was generally supported.**
4. Gains in expressive and/or receptive vocabulary over a one year period will be associated with decreases in physical aggression over this same time period.	**Hypothesis was not supported**.
5. Declines in executive dysfunction (i.e., improvement) over a one year period would be associated with decreases in physical aggression over this same time period.	**Hypothesis was partially supported**.

number of times a child aggressed would likely yield greater variability. This issue is given further consideration in Study 2.

Consistency Between Parent and Teacher Ratings

Generally speaking there seemed to be a similar pattern of findings, regardless of whether parent or teacher ratings of aggression or executive function were employed. However, as noted throughout the results section, some minor differences were found. Given the number of analyses conducted, as well as limited power in some cases, these variations may well be due to random error. As mentioned above, parent and teacher ratings of aggression were found to be significantly correlated. Correlations among the BRIEF-P scales when using the *same* rater tended to be higher than correlations for scales that went *across* raters. Shared method variance may have inflated the correlations which employed the same raters, as responses may reflect an overall view or bias which the individual holds about the child. However, although somewhat lower, correlations among the BRIEF-P scales across raters were also generally found to be statistically significant.

The Connection Between Vocabulary and Physical Aggression

The hypotheses that better expressive and receptive vocabulary skills would be associated with and predictive of lower physical aggression was partially supported by the results of this study. Better vocabulary scores were concurrently associated with lower parent and teacher ratings of physical aggression at Time 1, but not at Time 2. One likely explanation for the difference in findings from Time 1 to Time 2 has to do with sample attrition. Indeed, the magnitude of the association between parent-rated physical aggression and language competencies was near identical at both time points. Unfortunately, the substantial decrease in available participants at Time 2 reduced the power to detect these associations. In general

though, the results of Study 1 are consistent with previous research pointing to a relationship between vocabulary and physical aggression (e.g., Dionne et al., 2003).

Throughout Study 1, expressive vocabulary was more often associated with physical aggression than was receptive vocabulary. Theoretically, this finding may mean that the relationship between expressive vocabulary and physical aggression is somewhat more meaningful or robust than the relationship between receptive vocabulary and physical aggression.

Few studies have considered how specific components of language ability may be differentially related to aggressive behaviour. One such study by Villemarette-Pittman, Stanford and Greve (2002) addressed the relative strength of the relationships between expressive vocabulary and impulsive aggression ("emotionally charged, uncontrolled" verbal or physical aggression; p. 1534) and between receptive vocabulary and impulsive aggression in a sample of adults. These researchers classified participants into two groups: those with a significant recent history of impulsive aggressive behaviour, and those without such a history (control group). As expected, the "impulsive aggressors" showed poorer vocabulary skills than the control group. Moreover, the discrepancy between the two groups' expressive skills was larger than the discrepancy between their receptive skills. The authors of this study speculated that this was because the expressive task employed in this study (Expressive Vocabulary Test; Williams, 1997) demanded greater executive skills than did the receptive language measure (Peabody Picture Vocabulary Test-IIIA; Dunn, & Dunn, 1997). Similarly, this may be the reason why expressive vocabulary (rather than receptive) was more often found to be significantly associated with physical aggression among preschoolers in the current study. Likewise, it may be that expressive language measures may require children to utilize more cognitive resources in general

as compared to receptive language tasks. Accordingly, expressive language may be a marker of more advanced cognitive functioning in general, which in turn coincides with both greater inhibition skills and less physically aggressive behaviour. This interpretation is supported by research which suggests aggression to be associated with general cognitive ability among children aged 3-5 years, particularly when paired with a difficult temperament (Sakimura, Dang, Ballard, & Hansen, 2008). Alternatively, or in addition, it may be that expressive skills more strongly relate to physical aggression among preschool children, as expressive language offers a direct alternative to physical aggression in order to attain one's wants and needs.

The Connection Between Inhibition and Physical Aggression

The hypothesis that better executive function skills would be associated with and predictive of less physical aggression was generally supported by the results of this study. Significant correlations were found between several executive function scales and physical aggression. The hypothesis that executive function skills would also *predict* physical aggression was supported, however these analyses were limited to the Inhibition subscale of the BRIEF-P. Building on existing literature (e.g., Raaijmakers et al., 2008) the current empirical results point to inhibition skills in particular as an aspect of executive function that is especially relevant to the prediction of physical aggression.

According to Welsh (2002), inhibition skills are typically evident by 2 years of age; research by Epsy and colleagues (2001) suggests that these skills may even begin to develop as early as 12 months of age, when marked developments occur in the dorsolateral prefrontal cortex. Accordingly, inhibition may be more easily measured than other components of executive function during the preschool years, as inhibition may be the most well developed of the executive skills. Therefore measurements of inhibition may be more valid and more robust

than measurements of other executive skills during the preschool years (Raaijmakers et al., 2008). If this were the case, this could help explain why inhibition demonstrated consistently stronger relationships with physical aggression than did the other components of executive functioning. It may also be that inhibition is simply be more relevant to physically aggressive behaviour than other aspects of executive function. This is supported theoretically (e.g., Zelazo et al., 1997) by the notion that inhibition deficits may underlie all impairments in executive function. In sum, inhibition may develop earlier than other executive domains, be more easily measureable during the preschool years, and/or be more directly relevant to the development of physical aggression.

Finally, the way inhibition was assessed in the current research may also have impacted the extent to which it was found to be related to physical aggression. Specifically, the BRIEF-P inhibition items focus on behavioural markers of inhibition which overlap to some extent with the current assessment of physical aggression. In general, the BRIEF-P measures behaviours (which occur in the natural environment) thought to be related to underlying executive abilities. In this way, it differs to some extent from performance-based tasks of executive function, both theoretically and statistically (McAuley et al., 2010). The use of this measure allowed for less overlap with the assessment of children's vocabulary, as the BRIEF-P rating scale is not reliant on children's abilities to communicate with an examiner (as is the case with performance-based measures of executive function). However, there appeared to be overlap between the assessment of physical aggression and 3 of the 16 BRIEF-P inhibition items (i.e., "has to be more closely supervised than similar playmates"; "gets out of control more than playmates"; "acts wild or out of control") in particular. The remaining items measuring inhibition were more independent from physical aggression (e.g., "does not stop laughing at funny things or events when others stop").

It is worth noting, however, that despite any overlap between the behaviours assessed by the inhibition measure and the CBS measure in this study, inhibition (rated by either parent or teacher) at Time 1 was predictive of Time 2 physical aggression scores over and above the effect of Time 1 physical aggression. Conceptually, this is a particularly important finding as it provides evidence to suggest that the connection between inhibition (as measured by the BRIEF-P) and aggression is not simply an artefact of the way these constructs are measured.

Change Over Time: Physical Aggression, Vocabulary and Executive Function

The hypothesis that gains in expressive and/or receptive vocabulary over a one year period would be associated with decreases in physical aggression over this same time period was not supported. However, parent-reported increases in inhibition, emotional control and working memory skills were all significantly related to decreases in physical aggression between Time 1 and Time 2 of this study. This provides further evidence that certain aspects of executive function were relatively more predictive of physical aggression in the present study than were vocabulary skills.

Summary of Study 1

Although executive function may have been a stronger predictor of physical aggression (relatively speaking), overall, findings suggest that vocabulary and executive function (specifically inhibition) both appear to be somewhat relevant to the development and inhibition of physical aggression during the preschool years. Taken together (cumulatively), inhibition and vocabulary skills accounted for between 11 and 50 percent of the variance in parent and teacher reports of physical aggression in the present research when associates were evaluated concurrently. The magnitude of variance accounted for did not appear to differ as a function of whether parents or teachers rated either executive function or physical aggression. Predicting

physical aggression over a one-year period, vocabulary (expressive and receptive) alongside inhibition (parent or teacher reported) accounted for a notable proportion of variance (11 to 12%) even when the stability of physical aggression was controlled. Although it is widely accepted that physical aggression is influenced by a multitude of factors, the results of the present study suggest that a considerable amount of variance can be accounted for by the combination of language and inhibition.

A second goal of this study was to assess the *relative* predictive value of executive function and vocabulary skills. Based on the results of both correlational analyses and hierarchical regression, the results of Study 1 suggest that the relationship between inhibition skills and physical aggression is comparatively stronger than the relationship between vocabulary and physical aggression. Correlations between vocabulary and physical aggression did not emerge as significant at Time 2, while correlations between most of the executive function scales and physical aggression were significant at both time points in this study. Moreover, regression analyses revealed that vocabulary skills did not add significantly to the prediction of physical aggression scores once inhibition skills had been accounted for; conversely, inhibition skills were significantly predictive of aggression even after accounting for vocabulary skills. Lastly, changes in parent-rated executive function skills (inhibition, emotional control, working memory) were significantly associated with parent-reported changes in physical aggression, while changes in vocabulary skills were not significantly associated with changes in physical aggression. All of these findings suggest that inhibition appears to be a stronger predictor of physical aggression than is vocabulary.

This finding is novel, as no other known published research study has specifically compared the relative importance of executive function and language in the prediction of

physical aggression. The strength of inhibition as a predictor, however, is consistent with existing findings in the aggression literature. Specifically, Villemarette-Pittman and colleagues (2002) found that compared to a control group, participants (mean age = 19 years) classified as "impulsive aggressors" performed increasingly more poorly on tasks of verbal output as the tasks became more structured and reliant on executive function skills. These authors ultimately concluded that the results of their study "implicate[d] executive system dysfunction as the mechanism underlying the impulsive aggressors' inferior performance on verbal tasks" (Villemarette-Pittman et al., p. 1542).

While the current research suggests that both executive function and vocabulary skills are related to physical aggression among preschool children, inhibition skills appear to be the most pertinent among the predictor variables assessed. As suggested above in the Introduction, during the first year of life, prior to what may be a sensitive period for learning to inhibit aggressive tendencies, infants may naturally learn to respond to certain situations with physical aggression as a functional means for attaining various needs and resources. Subsequently, during the second year of life, when most children become socialized to respond in other ways in order to get these needs met, some children with poorer inhibition skills continue to rely on a previously functional script which allows for the use of physical aggression. It seems that preschool children (mean age = 42 months) with relatively poorer cognitive inhibition skills were more likely to exhibit high levels of physical aggression. Given the current findings, this is potentially one developmental path which can lead children towards an atypically high expression of physical aggression during the late preschool years (and likely beyond). As a possible extension of this finding, Study 2 considered whether inhibition skills were more or less relevant to physical aggression at an even earlier stage of development. It may be that gains in language and

executive domains during the proposed sensitive period for learning to inhibit physical aggression (24-36 months; Tremblay, 2000; 2001) are more strongly related to changes in physical aggression during this younger age.

It should also be noted that Study 1 was limited by the inclusion of only cognitive constructs (i.e., language and executive skills) in the prediction of physically aggressive behaviour. Research suggests that social-interactional domains such as attachment (e.g., Baron & Richardson, 1994; Lyons-Ruth et al., 1993; Marcus & Kramer, 2001; Moss et al., 2006; Renken et al., 1989) and parenting approaches (e.g., Bandura, 1973; Eron & Huesmann, 1984; Kimonis et al., 2006; Olweus, 1980; Patterson et al., 1989) may also be relevant to physical aggression.

Study 2

Returning to the primary research question, Study 1 addressed the relative and cumulative relations between physical aggression and cognitive variables (aspects of executive function, receptive vocabulary and expressive vocabulary). In an effort to address some of the limitations described for Study 1 (e.g., limited focus on the cognitive domain, the measurement difficulties associated with capturing change in physical aggression), Study 2 was designed to extend the scope of the examination and address the second element of the primary research question by incorporating social-interactional variables (attachment and parenting styles) alongside cognitive factors. In order to improve our understanding of the mechanisms involved with physical aggression it is important to attend to multiple domains (Tourigny, 2004; Tremblay, 2000).

As in Study 1, caregiver (both parents and childcare providers) reports of physical aggression were assessed in relation to children's scores on various domains of executive function, as well as in relation to children's expressive and receptive vocabulary. Of interest was

the question of whether gains in executive and verbal domains over the course of a 12-month interval were related to changes in caregiver-reported physical aggression to the same degree as was found in Study 1. In addition, Study 2 incorporated measures of parenting styles and children's attachment, in order to assess the relationship between each of these variables and children's reported levels of physical aggression. Attachment was also considered as a mediator in the relationship between parenting styles and physical aggression. Accordingly, it was predicted that the magnitude of the association between parenting style and aggression would decrease significantly once attachment quality had been controlled for.

In keeping with the underlying research question of interest, Study 2 explored the relative strength of association for multiple domains (cognitive and social-interactional) in the prediction of physical aggression and evaluated the cumulative predictive power when elements of both domains were considered together. In doing so, the current research allowed for a comparison of several key variables, both cognitive and social interactional (which are differentially important within different theoretical perspectives), in order to examine the question of whether cognitive variables are more strongly tied to physical aggression as compared to indicators of social interaction during the preschool years.

Finally, in order to address the second research question, regarding the possibility of a sensitive period, Study 2 included a sample of children who were on average younger (and closer to the proposed sensitive period) than children in Study 1. Specific findings from Study 2 were then compared to the results of Study 1 in order to make inferences regarding the importance of developmental timing for gains in either executive or verbal domains. These analyses do not, however, allow for a definitive conclusion regarding the possibility of a sensitive period for learning to inhibit physically aggressive tendencies but rather afford the opportunity to consider

whether the results of this research are consistent with the notion of a sensitive period. It is predicted that gains in executive function and in vocabulary skills over a one-year period would be more strongly tied to decreases in physical aggression when assessed in closer proximity of the proposed sensitive period (Study 2) than at a later developmental period (Study 1).

Research questions and hypotheses in Study 2 (described below) were examined using a short-term longitudinal design following participants at two time points over a one-year period using a multiple informant research strategy (both parents and daycare teachers; DiGiunta et al., 2010).

Study 2 Hypotheses

H1: Better expressive vocabulary will be associated with and predictive of lower physical aggression (concurrently).

H2: Better receptive vocabulary will be associated with and predictive of lower physical aggression (concurrently).

H3: Higher levels of executive dysfunction will be associated with and predictive of higher levels of physical aggression (concurrently).

H4: Greater difficulties with attachment will be associated with and predictive of higher physical aggression (concurrently).

H5: Higher levels of both Authoritarian and Permissive parenting will be associated with and predictive of higher physical aggression, while higher levels of Authoritative parenting will be associated with lower physical aggression (concurrently).

H6: Attachment will mediate the link between parenting styles and physical aggression.

H7: Gains in expressive and/or receptive vocabulary over a one year period will be associated with decreases in physical aggression over this same time period.

H8: Declines in executive dysfunction (i.e., improvement) over a one year period would be associated with decreases in physical aggression over this same time period.

Measurement of Aggression

Of additional interest in Study 2, was whether findings might vary depending on how caregivers (parents and daycare providers) were asked to report on or rate children's physical aggression. To this end, physical aggression in Study 2 was measured in four ways. The first was a typical measure of the frequency of childhood aggression, specifically items from the Child Behaviour Survey (CBS; described below). This was the sole measure of physical aggression employed in Study 1. The use of this measure in Study 1 prompted questions regarding the subjective nature of the items. For example, all of the CBS items included the word "many", such as in the item "gets into many fights". What constitutes "many" is a highly subjective judgment and may vary across respondents and across time (e.g., at different points of study or with increasing age). This appeared to be the case in Study 1, as respondents may have employed higher standards of conduct at Time 2 once the children were a year older. Accordingly, the use of subjective frequency items may make it difficult to accurately see any longitudinal changes in physically aggressive behaviour. Similarly, the CBS employs a three-point scale (never, sometimes, often), which restricts variability. A five or seven point scale is more fine-grained and as such may be more sensitive to change over time. In order to address these shortcomings of the CBS measure of physical aggression, additional items were added to measure how many times per week respondents thought a child typically aggressed in a physical way, perceptions of how aggressive the child was compared to their same-aged peers, and the extent to which respondents themselves (parents or daycare providers) worried about the child's level of physical aggressiveness. The psychometric properties (e.g., internal consistency and predictive validity)

of these four varying measures of physical aggression were then examined as well as the intercorrelations between these varied indices of physical aggression.

Study 2 Method

Participants

A total of 41 childcare facilities and approximately 250 families were approached regarding participation in Study 2. The first phase of Study 2 involved parents and daycare teachers who reported on a total of 85 children (participation rate of approximately 34%). Of these children, 44 (52%) were male and 41 (48%) were female. At Time 1, all children were between 22 and 55 months of age (mean age = 34 months, *SD* = 8.46), and living in Saskatoon, Saskatchewan, North Battleford, Saskatchewan, Saint John, New Brunswick, or Quispamsis, New Brunswick. The largest proportion of parents reported that they were "married" (46%), while 42% reported themselves to be "single".

After extensive efforts to re-engage parents and daycare providers in the second wave of this study, a total of 29 children were included one year later at Time 2, representing 34% of the original sample. Of these children, 12 (59%) were male, and 17 (41%) were female, all between 35 and 66 months of age (mean age = 45 months, *SD* = 8.91). Once again, at this time point most parents reported themselves to be "married" (52%), with 44% declaring themselves as "single".

Procedure

Daycare centres were contacted over the telephone and provided with Study 2 recruitment forms. Consent forms (see Appendix F) containing information about the study were given to the parents/guardians of all of the children who were between 24 and 36 months of age. Daycare employees were responsible for distributing the consent forms to the appropriate parents. On this consent form, all parents/guardians were informed that this was to be a two-part

study. Once daycares had been contacted and recruitment had begun, an additional seven participants were recruited via word of mouth. Subsequently, all consenting parents were provided with a research questionnaire packet (including the demographic/background measure, the CBS physical aggression items, the BRIEF-P, the PSDQ and the KCAQ) by the primary researcher. At the end of this questionnaire package, parents/guardians were asked to provide their contact information if they were interested in participating in the second phase of Study 2. At each time point of Study 2, participating parents/guardians were remunerated with $5 Tim Horton's gift certificates. In addition to parent/guardian data, consenting daycare teachers (one per participating child) were also asked to complete physical aggression measures as well as the BRIEF-P. Finally, participating children were administered the appropriate BSID-III subscales individually, in a quiet area of the room, within view of daycare staff.

At Time 2, parents were contacted directly about participation in the second wave of data collection. In some cases children remained in the same daycare, however in other cases, children had relocated to another daycare centre, or were no longer attending a daycare at all. In these latter cases, data collection was either arranged through the child's current daycare, or the primary researcher made arrangements to meet with participants at a location of their convenience (e.g., on campus or in the participant's home).

Following the completion of data collection at Time 1, all participating parents and daycare providers were offered information pertaining to concerns about physical aggression. For daycare providers, this included a seminar on empirically-based strategies for dealing with aggressive behaviour problems as well as some resource references pertaining to physical aggression research and management. A list of referral sources in the participants' geographical

area was also provided to both parents and daycare staff. Participating daycares were given a small gift certificate as a thank you for their involvement in the research.

Measures

The forms and measures distributed to participants for Study 2 are presented in Appendices F-K.

Demographic/background questionnaire. Parents were asked to complete a demographics measure (see Appendix G) in order to assess factors such as the child's age (in months), the child's sex, the number of other children living in the child's home, the relationship of the respondent to the child, and the primary and spoken languages in the home (e.g., English, French, Cree, etc.).

Physical aggression. Consistent with the way physical aggression was assessed in Study 1, three items pertaining to physically aggressive behaviour were administered from the Child Behaviour Survey (CBS), taken from the National Longitudinal Survey of Children and Youth (NLSCY; Statistics Canada, 2007a; Statistics Canada, 2007b). As in Study 1, respondents were provided with a choice of three responses (0 = "never or not true", 1 = "sometimes or somewhat true", 2 = "often or very true"), and asked to rate the frequency with which the child engages in each of the stated behaviours. One of the items to be administered, however, differed from that of Study 1. The item "physically attacks people" was not administered in Study 2, because in the NLSCY, it was not deemed appropriate for children under the age of 4 years. Instead, this item was replaced by another item from the CBS. Accordingly the three CBS items employed in Study 2 were: "kicks, bites, hits other children," "gets into many fights," and "reacts with anger and fighting" (see Appendix H). All of these items have been administered to children from 2-11 years of age in the NLSCY (Statistics Canada, 2007b). Also, these three items were used by Cote

and colleagues (2007) to assess physical aggression in a longitudinal study of children from 2-6 years of age. These researchers reported that the reliability coefficients for the composite of three parent-rated physical aggression items were 0.66 at 2 years of age and 0.65 at 4 years of age (Cote et al., 2007). In the current research, reliability coefficients for this measure were 0.58 for parents at Time 1, 0.82 for daycare teachers at Time 1, 0.72 for parents at Time 2, and 0.96 for daycare teachers at Time 2.

Three additional measures of physical aggression were also employed in Study 2. The first of these measures asked respondents to estimate the number of times per week a child engaged in the behaviours assessed by the CBS ("kicks, bites, hits other children," "gets into many fights," and "reacts with anger and fighting."). A scale score was created by averaging responses on the three items measuring different physically aggressive behaviours. Cronbach's alpha for this measure of times per week were found to be 0.60 for parents at Time 1, 0.95 for teachers at Time 1, 0.63 for parents and Time 2, and 0.95 for teachers at Time 2.

Using a 5-point-likert scale and the same three behaviours, respondents were also asked how aggressive the child was compared to same-aged peers, where 1 = "a lot less" and 5 = "a lot more". The scale score on perceived aggressiveness was computed by average the three items with higher scores indicative of a stronger perception that one's child is highly aggressive compared to same-aged peers. Reliability coefficients for this measure of perceived aggressiveness were 0.90 for parents at Time 1, 0.94 for teachers at Time 1, 0.73 for parents at Time 2, and 0.98 for teachers at Time 2.

Finally, using a 4-point scale from 1 = "not at all" to 4 = "I worry a lot", respondents were asked to rate the extent to which they worried about the child "kicking, biting, hitting other children", "getting into many fights," and "reacting with anger and fighting". A score on this

worry measure was created by averaging responses across the three items with higher scores representing greater worry about the aggressive behaviour of one's child. This measure of worry yielded internal consistency values of 0.82 for parents at Time 1, 0.96 for teachers at Time 1, 0.77 for parents at Time 2, and 0.96 for teachers at Time 2.

Executive function. As in Study 1, the Behavior Rating Inventory of Executive Function – Preschool Version (BRIEF-P) was used in order to assess various aspects of children's executive function. As mentioned for Study 1, the BRIEF-P includes five clinical scale scores (Inhibit, Shift, Emotional Control, Working Memory, and Plan/Organize), along with three index scores (Inhibitory Self-Control, Flexibility, and Emergent Meta-Cognition), and an overall score (the Global Executive Composite). Respondents are asked to rate the frequency with which children engage in stated behaviours, using a 3-point-likert scale, (1 = "Never", 2= "Sometimes", and 3 = "Often"). Higher scores on any of the scales or indexes represent dysfunction in the respective domains of executive function (Gioia, Espy, & Isquith, 2003). Internal consistency values for this measure in the current study are presented in Table 8 and raw scores were used in all analyses.

As was done with Study 1, the BRIEF-P negativity subscale was computed for parents and teachers at both time points of Study 2 to assess the degree to which respondents approached the measure in "an unusually negative manner" (Gioia et al., 2003, p. 16). At Time 1, the mean on this scale was 0.24 (*SD* = 0.60) for parents and 0.98 (*SD* = 1.39) for teachers. At Time 2, means were 0.21 (*SD* = 0.51) for parents and 1.18 (*SD* = 1.97) for teachers. The means for parents and teachers are all within the "acceptable" range (i.e., less than 3; Gioia et al., 2003). The BRIEF-P inconsistency index was also calculated in order to assess the extent to which respondents provided consistent ratings on similar items. At Time 1, the mean inconsistency

Table 8

Cronbach's Alpha Reliability Values for BRIEF-P in Study 2

	Inhibit	Shift	EC	WM	P/O
T1 Teacher	0.93	0.82	0.93	0.92	0.84
T1 Parent	0.89	0.77	0.86	0.88	0.80
T2 Teacher	0.96	0.78	0.95	0.95	0.92
T2 Parent	0.93	0.78	0.89	0.90	0.82

score was 4.26 (*SD* = 0.54) for parents and 5.95 for teachers (*SD* = 0.33). At Time 2, means on this scale were 0.50 (*SD* = 0.51) for parents and 4.29 (*SD* = 2.47) for teachers. All of the inconsistency scale means for the current sample are within the "acceptable" range (i.e., less than 7; Gioia et al., 2003).

Receptive communication. The Bayley Scales of Infant and Toddler Development – Third Edition (BSID-III, Bayley, 2005) was used to assess children's receptive communication skills. Specifically, the Receptive Communication Subtest was employed for this purpose. The BSID-III was standardized using a U.S. sample of 1,700 children from1-42 months of age. The standardization sample was divided into 17 age groups in all, with 100 children in each group. Across these age groups, the average (split-half) internal consistency coefficient for the Receptive Communication Subtest was found to be 0.87 (Bayley, 2005). For children in groups between the ages of 24 and 42 months of age, the alpha coefficients were found to range from 0.93-0.96. The test-retest reliability of the Receptive Communication Subtest was reported to be .70 (corrected *r* = 0.87) for children from 19-26 months of age and .81 (corrected *r* = 0.90) for children aged 33-42 months. In terms of validity, Bayley (2005) reported that Receptive Communication scores from the BSID-III standardization sample were found to correlate positively (*r* = 0.82) with Verbal IQ scores on the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III).

Expressive communication. The Expressive Communication Subtest of the BSID-III (Bayley, 2005) was employed to assess children's expressive language skills. Across the 17 age groups in the standardization sample, the average (split-half) internal consistency coefficient for the Expressive Communication Subtest was found to be 0.91 (Bayley, 2005). For children in groups between the ages of 24 and 42 months of age, the alpha coefficients ranged from 0.96-

0.97. The test-retest reliability of the Expressive Communication scale was .73 (corrected *r* = .85) for children aged 19-26 months and .81 (corrected *r* = 0.94) for children aged 33-42 months. Bayley (2005) reported that Expressive Communication scores also correlated (*r* = 0.79) with Verbal IQ scores on the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III).

Parenting styles. The Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson, Mandleco, Olsen, & Hart, 2001; see Appendix I) was employed to assess parenting styles. This is a 32-item measure which assesses the three parenting styles of Baumrind's model: authoritative, authoritarian and permissive. Parents rate the degree to which they agree with each of the 32 statements using a 5-point likert scale ranging from 1 = "Never" to 5 = "Always". Example items include "I explain the consequences of the behavior" (authoritative parenting; 14 items), "I give in to our child when the child causes a commotion about something" (permissive parenting; 6 items), and "I scold or criticize when our child's behavior doesn't meet our expectations" (authoritarian parenting; 12 items). Respondents obtain a score on each of the three scales by totalling items together, where high scores indicate higher levels of a particular parenting style. Satisfactory internal consistency scores have been found for the authoritative, authoritarian, and permissive subscales (Cronbach's alpha = 0.84, 0.76, 0.72, respectively; Soward, 2006). Coolahan, McWayne, Fantuzzo, and Grim (2002) reported that the Cronbach alpha coefficient for the total score was 0.77. The current study revealed Cronbach alpha values for the authoritative, authoritarian, and permissive subscales of 0.84, 0.87, and 0.74, respectively at Time 1 and 0.86, 0.91, and 0.77, respectively at Time 2.

Attachment. Although in some ways it would have been desirable to assess attachment *style* (e.g., secure, avoidant, anxious/ambivalent, disorganized/disoriented) in the current study,

at this time there is no acceptable parent-report instrument of attachment style for children age 2-3 years with adequate psychometric properties (Cugmas, 1998; Cugmas, 2004; Cugmas, 2007; Kappenberg & Halpern, 2006; Tourigny, 2004). This led to the use of a more global measure of attachment quality (i.e., extent of attachment difficulties) in the present research. Parents were asked to complete the Kinship Center Attachment Questionnaire (KCAQ; Kappenberg & Halpern, 2006). This is a screening instrument designed to measure the "*extent to which a child is attached to a caregiver*" and which allows for attachment difficulties to be tracked qualitatively over time (Kappenberg & Halpern, 2006, p. 855). This is a 20-item measure of attachment difficulties, which uses a 7-point-likert scale ranging from 0 = "Never/Rarely" to 6 = "Almost Always". This measure was standardized with a sample of 362 primary caregivers from the Southern California region. The measure yields a total score, with higher scores being indicative of greater attachment difficulty (Kappenberg & Halpern, 2006; see Appendix J).

In two separate studies, the KCAQ total score was shown to have acceptable internal consistency (alpha = 0.74 and 0.75; Kappenberg & Halpern, 2006). Discriminative validity was also evidenced, as a statistically significant difference in the KCAQ total score emerged between a clinical and a non-clinical sample of children (Kappenberg & Halpern, 2006). Significant small to moderate correlations (0.22-0.59) were found between KCAQ scores and all Child Behaviour Checklist 1.5-5 scales (Emotional Problems, Anxious/Depressed, Somatic Problems, Withdrawn, Sleep Problems, Attention Problems, Aggression, and Total Problems) suggesting evidence of convergent validity (Kappenberg & Halpern, 2006). The internal consistency of this measure was 0.77 At Time 1 and 0.84 at Time 2 in the current study.

Study 2 Results

Data Cleaning & Analyses

Prior to analyzing the data from Study 2, the data was screened and, in some cases, variables were transformed and outliers were deleted. At both Time 1 and Time 2, in order to obtain a more normal distribution of scores, seven groups were created for both the parent and teacher scale regarding how often children usually aggressed in a physical way during the course of a typical week. Parent and teacher scores were grouped differently, reflecting different distributions of scores. In general, teachers reported somewhat higher scores, especially for children with higher reported levels of physical aggression. For parents, after averaging the scores of the three items on this measure, group one included children who were reported to aggress zero times during the course of a typical week, group two included children who were reported to aggress more than zero times per week, up to 0.99 times, group three consisted of children who scored from 1-1.99, group four included children who scored from 2-2.99 incidences of physical aggression per week on average, group five ranged from 3-3.99, group six ranged from 5-5.99 and group 7 included all children who were reported to aggress 6 or more times per week on average. For teacher scores on this measure, group one consisted of children who were reported to display zero incidences of aggression during a typical week on average, group two included children who scored above zero but less than 1.99 per week, group three consisted of children scoring between 2 and 3.99, group four scored from 4-5.99, group five scored from 6-7.99, group six from 8-9.99 and finally, children in group seven were reported to display on average 10 or more incidences of physical aggression during a typical week. Accordingly, with the exception of scores in the upper and lower extremes, scores were grouped using equal interval scaling. Raw scores were used for the purpose of reporting descriptive

results below, however, for all other analyses, grouped scores were employed (Tabachnick & Fidell).

At Time 1 only, both receptive and expressive vocabulary scores (raw scores) were reflected and transformed by square rooting these scores, again in order to provide a more normal distribution. Accordingly, this means that at Time 1 high scores on these measures reflect low levels of vocabulary, and vice versa. Conversely, at Time 2, high scores reflect a high level of vocabulary while low scores reflect a lower level of vocabulary.

As in the first study, Study 2 included hypotheses about whether cognitive factors such as vocabulary (receptive and expressive) and executive functioning would be predictive of physical aggression (criterion). However, Study 2 also incorporated some additional social-interactional variables also thought to relate to physical aggression: parent reports of their own parenting style and perceptions of their child's attachment. Accordingly, analyses were conducted to examine the inter-correlations of all predictors with the criterion. Questions about the cumulative and relative contributions of these predictors in explaining variance in physical aggression were examined using a series of multiple regressions for Time 1 and Time 2 separately.

Attrition

Twenty-eight children were included in Time 2 data analyses. Only 19 of the children included at Time 2 had data from teachers regarding physical aggression. When Time 2 follow-up occurred, some of the children who were previously in daycare were no longer there and in many cases these children had moved or had changed their contact information and as such could not be included at Time 2. Conversely, all of the participating children who were not enrolled in daycare at Time 1 were also included in the study at Time 2. Accordingly, more parent data (n = 24) was collected at Time 2 than teacher data (n = 19). This sample size restricted what analyses

could be conducted, especially with teacher data. At Time 1, there was a similar amount of discrepancy between parent and teacher data, however, as more parent data (n = 71) was collected than teacher data (n = 53) at Time 1 as well.

In order to assess whether there were any differences between those included at Time 1 only and those included in both waves of data collection, a series of independent sample t-tests were conducted. At Time 1, no significant differences in age, t (72) = -0.58, p = 0.82, CBS parent-reported physical aggression, t (45) = -0.88, p = 0.76, or CBS teacher-reported physical aggression, t (51) = -1.56, p = 0.30 were found between those who were later included at Time 2 and those were not.

Descriptive Results

All of the BRIEF-P normative sample means for the five subscales of executive function were within one standard deviation of the current sample means (Gioia et al., 2003). This suggests that executive skills in the current sample are comparable to a wider, general population (see Table 9).

Raw scores on this measure range from 0-48. Mean raw scores were found to be 35.51 (*SD* = 6.81) for receptive vocabulary and 37.87 (*SD* = 8.05) for expressive vocabulary at Time 1. At Time 2, the mean for receptive vocabulary was 42.33 (*SD* = 3.04) while the mean expressive vocabulary score was 45.70 (*SD* = 3.22). Overall, these scores suggest that children in this sample generally showed developmentally appropriate vocabulary skills at each of the two time points.

Gender differences in physical aggression. Means for boys and girls are presented separately in Table 10 and 11 alongside the results of a series of t-tests. Although the physical aggression scores for boys were consistently higher than those of girls, only 4 of these 16

Table 9

BRIEF-P Raw Score Means and Standard Deviations

Measure	T1 Teacher	T1 Parent	T2 Teacher	T2 Parent
Inhibit	28.02	24.45	30.38	23.96
(*SD*)	(8.31)	(5.75)	(9.59)	(6.83)
Shift	15.08	13.52	14.30	13.21
(SD)	(3.98)	(2.94)	(3.53)	(2.87)
Emotional	16.83	14.80	17.82	14.75
Control *(SD)*	(5.74)	(3.91)	(6.34)	(3.86)
Working Memory	28.08	24.98	29.00	23.12
(SD)	(7.32)	(5.48)	(9.06)	(5.53)
Plan/Organize	16.81	14.67	18.05	14.79
(SD)	(4.17)	(3.27)	(5.34)	(3.44)
N	54	46	22	24

Table 10

Mean Physical Aggression Scores for Boys and Girls

Measure	T1 Teacher CBS	T1 Parent CBS	T1 Teacher Times per Week	T1 Parent Times per Week	T2 Teacher CBS	T2 Parent CBS	T2 Teacher Times per Week	T2 Parent Times per Week
Overall Mean	1.74	1.64	4.21	2.18	1.77	1.50	4.06	1.86
SD	0.58	0.38	6.32	2.17	0.70	0.40	9.11	2.74
Boys Mean	1.82	1.76	4.92	3.13	1.77	1.59	13.76	3.80
SD	0.61	0.42	7.66	2.26	0.80	0.43	4.59	1.27
Girls Mean	1.68	1.55	3.60	1.47	1.77	1.44	1.59	1.47
SD	0.55	0.33	5.01	1.49	0.66	0.39	0.44	0.39
Range of scores	1-3	1-3	open	open	1-3	1-3	open	open
t	0.89	-1.93	-0.72	**-2.24****	-0.03	-0.86	**-1.32****	**-1.74***
df	51	45	46	21	20	22	8	10
p	0.87	0.34	0.27	0.01	0.54	0.60	0.01	0.05

Note: All significant *t* values are in bold and are marked by asterisks.
* = $p < .05$, ** = $p < .01$.

Table 11

Mean Physical Aggression Scores for Boys and Girls

Measure	T1 Teacher Compared to Peers	T1 Parent CBS Compared to Peers	T1 Teacher Worry	T1 Parent Worry	T2 Teacher Compared to Peers	T2 Parent Compared to Peers	T2 Teacher Worry	T2 Parent Worry
Overall Mean	2.23	2.04	1.88	1.49	2.38	1.97	1.74	1.36
SD	1.26	0.87	1.00	0.61	1.44	0.73	1.07	0.51
Boys Mean	2.49	2.27	1.87	1.16	2.96	2.15	1.85	1.67
SD	1.383	0.85	1.05	0.69	1.44	0.69	1.27	0.62
Girls Mean	2.18	1.85	1.89	1.42	1.97	1.86	1.67	1.17
SD	1.16	0.85	0.96	0.53	1.35	0.76	0.95	0.31
Range of scores	1-5	1-5	1-4	1-4	1-5	1-5	1-4	1-4
t	-0.87	-1.73	0.09	-0.86	-1.64	-0.93	-0.39	**-2.56***
df	50	46	51	46	20	21	20	21
p	0.24	0.09	0.92	0.39	0.12	0.36	0.70	0.02

Note: All significant *t* values are in bold and are marked by asterisks.
* = $p < .05$, ** = $p < .01$.

differences reached statistical significance. Specifically, parent reports of the number of times per week that boys were physically aggressive were higher than those reported for girls at Time 1; both parent and teacher reports of times per week were higher for boys at Time 2; and, parents of boys reported worrying more about the level of their child's aggression at Time 2. This gender difference is consistent with previous research (e.g., Cote et al., 2006; Baillargeon et al., 2007).

Changes in physical aggression over time. Despite the fact that three out of four pairs of means move in the predicted declining direction over time, the results of four paired-samples t-tests showed that mean physical aggression scores at Time 1 and Time 2 were not significantly different on the parent CBS, t (20) = 0.86, p = 0.40, teacher CBS, t (18) = -1.45, p = 0.16, parent times per week, t (13) = 0.94, p = 0.37, or teacher times per week measure, t (16) = -1.33, p = 0.20.

Measurement of Aggression

Correlations between the various measures of physical aggression are presented in Tables 12 and 13. For both parents and teachers, considerable overlap was found between the CBS measure and each of the other three approaches to measuring physical aggression. In general, intra-rater (e.g., different aggression scores produced by teachers) correlations tended to be higher than inter-rater correlations (e.g., the correlation between the same measure of aggression produced by teachers and parents). Teachers, however, showed somewhat more intra-rater overlap between the four different aggression measures as compared to parents. Fisher's r to z transformations were conducted in order to test the significance of these differences at Time 1. The intra-rater correlations between CBS scores and estimates of times per week the child aggressed physically, between CBS scores and respondents' level of worry about the child's aggression, and between the child's aggression compared to peers and respondents' level of

worry were found to be significantly larger for teachers as compared to parents at Time 1 (all z's > +-1.96). At Time 2, the intra-rater correlations between CBS scores and respondents' level of worry about the child's physical aggression, and between the child's physical aggression level compared to peers and respondents' level of worry were significantly larger for teachers (all z's > +-1.96).

Moving beyond zero-order correlations, simple regression analyses were conducted to assess the degree to which CBS responses could be predicted by the two measures of physical aggression which most pertain to respondent characteristics. The measures of children's levels of aggression compared to peers (perceived aggressiveness) and respondents' level of worry about the child's aggression were thought to assess physical aggression in a more subjective manner than the measure of physical aggression which prompted respondents to estimate the number of times per week the child typically aggresses. Accordingly the extent to which the two subjective measures of physical aggression predicted CBS ratings yielded an estimate of the degree to which the CBS taps into respondent characteristics such as their knowledge of what is age appropriate for physical aggression and their tendency to worry about this behaviour. Results of this simple regression showed that responses on the items about children's levels of aggression compared to peers, and respondents' level of worry about the child's aggression accounted for a high degree of the variance in responses to the CBS for both parents, $R^2 = 0.46$, Adjusted $R^2 = 0.44$, F (2, 44) = 19.07, $p < 0.001$, and for teachers, $R^2 = 0.73$, Adjusted $R^2 = 0.72$, F (2, 48) = 19.07, $p < 0.001$ at Time 1.

Comparison Between Parent and Teacher CBS Ratings of Physical Aggression

The correlation between measures of aggression obtained by parents versus those obtained by teachers (e.g., CBS Parent Aggression and CBS Teacher Aggression at Time 1; see Tables 12 and 13) revealed a moderate to high degree of overlap between reports of aggression obtained from different raters. It was of additional interest, however, to document *which* children were being identified by raters as most highly aggressive. Using parent data, only one child was found to be rated a full standard deviation above the mean on the CBS measure of physical aggression at Time 1. Using teacher data, a total of 10 children fell one standard deviation above the mean on this same measure. Among these 10 children was the one child who had also been rated as highly aggressive by a parent.

Using a slightly more liberal cut-off, eighteen children were found to be a half a standard deviation above the mean on the CBS measure of physical aggression according to parents, and ten were rated to be at least a half a standard deviation above the mean for teacher ratings of physical aggression on this measure. A total of four children were a half standard deviation above mean CBS ratings according to both parent and teacher ratings.

Correlation Results (Hypotheses 1-5)

Hypothesis 1. It was predicted that better expressive vocabulary would be associated with lower levels of physical aggression. In order to test this hypothesis, CBS ratings were employed as an index of physical aggression, as this measure has previously been used in numerous studies (including Study 1) and its strengths and limitations are relatively well documented. The measure of teachers' and parents' estimates of how many times per week children typically aggressed was also employed in order to test this hypothesis given the suggestion that times per week may be a more objective measure of physical aggression.

Table 12

Bivariate Zero-Order Two-Tailed Correlations Between Physical Aggression Measures at Time 1

Measure	T1 Teacher CBS Aggression	T1 Parent CBS Aggression	T1 Teacher Times per Week Aggression	T1 Parent Times per Week Aggression	T1 Teacher Aggression Compared to Peers	T1 Parent Aggression Compared to Peers	T1 Teacher Worry About Aggression	T1 Parent Worry About Aggression
T1 Teacher CBS		**0.50****	**0.86****	0.34	**0.80****	**0.34****	**0.82****	0.15
T1 Parent CBS			**0.52***	**0.65****	**0.44***	**0.65****	**0.39***	**0.50****
T1 Teacher Times per Week				**0.49****	**0.76****	**0.40****	**0.75****	0.27
T1 Parent Times per Week					**0.49***	**0.57****	-0.05	**0.68****
T1 Teacher Compared to Peers						**0.44***	**0.82****	**0.35***
T1 Parent Compared to Peers							0.29	**0.49****
T1 Teacher Worry								0.14
T1 Parent Worry								

Note: All significant correlations are in bold and are marked by asterisks; df = 32-51; * = $p < .05$, ** = $p < .01$.

Table 13

Bivariate Zero-Order Two-Tailed Correlations Between Physical Aggression Measures at Time 2

Measure	T2 Teacher CBS Aggression	T2 Parent CBS Aggression	T2 Teacher Times per Week Aggression	T2 Parent Times per Week Aggression	T2 Teacher Aggression Compared to Peers	T2 Parent Aggression Compared to Peers	T2 Teacher Worry About Aggression	T2 Parent Worry About Aggression
T2 Teacher CBS		**0.64****	**0.92****	0.45	**0.80****	0.35	**0.86****	0.12
T2 Parent CBS			**0.63****	**0.78****	**0.59***	**0.67****	**0.66****	0.35
T2 Teacher Times per Week				0.46	**0.74****	0.39	**0.68****	0.07
T2 Parent Times per Week					0.46	**0.64****	**0.55***	0.40
T2 Teacher Compared to Peers						0.44	**0.85****	0.38
T2 Parent Compared to Peers							0.42	**0.49****
T2 Teacher Worry								0.20
T2 Parent Worry								

Note: All significant correlations are in bold and are marked by asterisks; df = 20-22; * = p <.05, ** = p < .01

At Time 1, neither parent nor teacher CBS ratings of physical aggression were found to be significantly correlated with expressive vocabulary (See Table 14). Using teacher estimates of the actual number of times week children physically aggressed, however, a significant positive relationship was found with expressive vocabulary. Given the data transformations that were made to expressive vocabulary skills (these scores were reflected then a square root transformation was conducted), this suggests that higher levels of physical aggression were associated with poorer vocabulary skills. The correlation between parent ratings of the number of times per week physical aggression occurred and expressive vocabulary was also positive and approached significance ($p = 0.06$; see Table 14). No significant findings between expressive vocabulary and physical aggression emerged at Time 2 (see Table 15).

Hypothesis 2. It was predicted that better receptive vocabulary would be associated with lower physical aggression. At Time 1, receptive vocabulary was not significantly associated with either teacher or parent ratings of physical aggression on the CBS. However, receptive vocabulary was significantly positively correlated with both teacher and parent reports of physical aggression on the times per week rating scale of physical aggression (see Table 14). Given the data transformation to receptive vocabulary, the direction of both of these correlations would suggest that a better understanding of spoken language is associated with less physical aggression. At Time 2, no significant correlations between physical aggression and receptive vocabulary were found.

Hypothesis 3. A series of correlation analyses were conducted in order to test the hypothesis that greater levels of executive dysfunction would be associated with higher levels of physical aggression. Both inter-rater and intra-rater correlations were conducted. Inter-rater analyses eliminated the confounding effects of shared method variance. Looking across raters,

Table 14

Bivariate Zero-Order One-Tailed Correlations Between Variables & Physical Aggression at Time 1

Measure	T1 Teacher CBS Aggression	T1 Parent CBS Aggression	T1 Teacher Times per Week Aggression	T1 Parent Times per Week Aggression
T1 Age	-0.21	0.00	**-0.26***	-0.22
T1 Receptive	0.17	0.09	**0.32***	**0.33***
T1 Expressive	0.14	-0.06	**0.27***	0.28
T1 Teacher Inhibit	**0.64****	**0.34***	**0.66****	0.31
T1 Teacher Shift	**0.46****	0.00	**0.71****	0.31
T1 Teacher EC	**0.75****	**0.33***	**0.74****	0.22
T1 Teacher WM	**0.32***	-0.05	**0.40****	0.19
T1 Teacher PO	**0.39****	0.12	**0.46****	**0.47***
T1 Parent Inhibit	**0.25****	**0.32***	0.30	**0.52****
T1 Parent Shift	**0.42****	**0.39****	**0.59****	**0.52****
T1 Parent EC	**0.35***	**0.45****	**0.38***	**0.51****
T1 Parent WM	0.19	0.19	0.24	0.27
T1 Parent PO	0.14	0.25	0.08	0.21
T1 Attachment	**0.45****	**0.36****	**0.40***	**0.66****
T1 Authoritarian	0.12	**0.28****	-0.09	0.14
T1Permissive	0.06	0.04	-0.08	0.06
T1 Authoritative	-0.22	-0.14	-0.30	-0.08
Mean	1.74	1.65	3.15	3.47
SD	0.58	0.38	1.77	1.75
N	53	47	47	34

Note: All significant correlations are in bold and are marked by asterisks; df = 51 – 32; * = p <.05, ** = p < .01.

Table 15

Bivariate Zero-Order One-Tailed Correlations Between Variables & Physical Aggression at Time 2

Measure	T2 Teacher CBS Aggression	T2 Parent CBS Aggression	T2 Teacher Times per Week Aggression	T2 Parent Times per Week Aggression
T2 Age	**-0.51***	0.00	**-0.55***	-0.29
T2 Receptive	-0.27	-0.13	-0.33	**-0.42***
T2 Expressive	-0.03	0.25	-0.05	-0.05
T2 Teacher Inhibit	**0.72****	**0.58***	**0.61****	**0.55***
T2 Teacher Shift	**0.77****	**0.61****	**0.80****	0.35
T2 Teacher EC	**0.86****	**0.86***	**0.81****	**0.63****
T2 Teacher WM	**0.51***	**0.58****	**0.45***	0.40
T2 Teacher PO	**0.54****	**0.69****	**0.46***	**0.44***
T2 Parent Inhibit	0.28	**0.56****	0.25	**0.51****
T2 Parent Shift	0.24	0.23	0.18	-0.04
T2 Parent EC	0.20	**0.40***	0.17	0.26
T2 Parent WM	0.21	0.31	0.20	0.12
T2 Parent PO	-0.04	0.21	-0.11	-0.02
T2 Attachment	0.08	**0.44***	0.07	0.31
T2 Authoritarian	0.04	**0.36***	0.03	0.22
T2Permissive	0.07	0.17	0.02	0.14
T2 Authoritative	-0.01	-0.24	-0.04	-0.26
Mean	1.77	1.50	3.69	3.48
SD	0.70	0.40	2.19	1.90
N	22	24	22	23

Note: All significant correlations are in bold and are marked by asterisks; df = 20 – 22; * = p <.05, ** = p < .01.

using the CBS measure of physical aggression, Time 1 correlations revealed that Inhibition and Emotional Control were the only *teacher-reported* scales of executive function that were significantly (positively) correlated with *parent-reported* CBS scores of physical aggression at Time 1. Still looking across raters, *parent-reported* Inhibition, Shift and Emotional Control skills were each significantly positive correlated with *teacher-reported* CBS scores of physical aggression at Time 1.

Also at Time 1, looking within raters, all five of the *teacher-reported* BRIEF subscales were found to be significant and positively correlated with CBS *teacher reports* of physical aggression. Time 1 *parent-reported* Inhibition, Shift, and Emotional Control were significantly positively correlated with Time 1 *parent reports* of physical aggression. All of the above correlations suggest that greater physical aggression at this age is associated with more poorly developed executive function skills.

Further evidence of this association was provided through the use of the times per week estimates of how often physical aggression actually occurs. Looking across raters, using this measure of physical aggression, Time 1 correlations revealed that Planning/Organizing was the only *teacher-reported* scale of executive function that was significantly (positively) correlated with *parent-reported* ratings of physical aggression. The correlation between *teacher-reported* Inhibition and times per week *parent-reports* of physical aggression did approach significance, however ($p = 0.07$). *Parent-reports* of Shift, and Emotional Control skills were significantly positively correlated with times per week *teacher ratings* of physical aggression, while the correlation between Inhibition and physical aggression approached significance ($p = 0.06$; see Table 14). Once again, these correlations all suggested that higher levels of physical aggression are associated with more poorly developed executive function skills.

Looking within raters at Time 1 using the number of times per week measure of physical aggression, again all five of the *teacher-reported* BRIEF-P subscales were found to be significant and positively correlated with times per week *teacher ratings* of physical aggression during a typical week. *Parent-reports* of Inhibition, Shift, and Emotional Control skills were also significantly positively correlated with *parent ratings* of physical aggression at Time 1.

At Time 2, looking across raters, all five of the *teacher-rated* BRIEF-P subscales were found to be significantly correlated with *parent-reported* physical aggression scores on the CBS measure. In all cases, the directions of these relationships suggested that better executive functioning was associated with less reported physical aggression. No significant relationships emerged between *teacher-rated* CBS scores and *parent-ratings* of executive function, however. Looking within raters at Time 2, *parent-rated* Inhibition skills and Emotional Control were significantly (positively) related to *parent-rated* CBS scores, while all five of the *teacher-rated* BRIEF-P subscales were found to correlate significantly with *teacher ratings* of physical aggression on the CBS measure.

Also at Time 2, a similar pattern of correlations emerged using the measure of how many time per week a child was reported to aggress physically. Looking across raters, *teacher-reported* Inhibition and Emotional Control skills were significantly positively associated with *parent-rated* physical aggression, while none of the *parent-rated* BRIEF-P subscales were found to be significantly associated with how many times per week *teachers reported* a child to be physically aggressive. Finally, within-rater correlations with the times per week measure also suggested that greater physical aggression at this age was tied to more poorly developed executive function skills at Time 2, as *parent ratings* of Inhibition were related to *parent-rated*

physical aggression, and all five of the executive function domains were significantly associated with physical aggression when *teacher ratings* were employed.

Hypothesis 4. It was predicted that fewer attachment difficulties would be associated with lower scores of physical aggression. At Time 1, scores on the KCAQ parent-report measure of attachment difficulties were significantly positively associated with both parent and teacher reports of physical aggression, using both the CBS and times per week measure of physical aggression (see Table 14). At Time 2, attachment scores on the KCAQ were significantly related to parent reports of physical aggression on the CBS measure only, while a relationship with the parent times per week measure approached significance ($p = 0.09$). These relationships all suggest that higher levels of parent-reported attachment difficulties are associated with higher levels of physical aggression.

Hypothesis 5. It was hypothesized that higher levels of both Authoritarian and Permissive parenting would be associated with higher physical aggression within a single time point, whereas higher levels of Authoritative parenting would be associated with lower scores of physical aggression. At both time points of the study, a significant positive correlation between Authoritarian parenting and parent-reported CBS scores of physical aggression was found, suggesting that a more Authoritarian parenting style related to higher levels of physical aggression among children (see Tables 14-15). In order to better understand why this result may have emerged (to be considered later, in the Discussion section), the correlation between Authoritarian parenting and the degree to which parents report worrying about their child's level of physical aggression was examined. This correlation approached significance at both Time 1, r (46)= 0.25, $p = 0.09$, and Time 2, r (21)= 0.31, $p = 0.08$. The direction of these marginally significant correlations suggests that parents using a more Authoritarian style may tend to worry

more about their child's level of physical aggression. The authoritarian approach may be rationalized if a parent is particularly worried about negatively perceived behaviours such as physical aggression, or it may be that those who are inclined towards authoritarian approaches have a high degree of sensitivity to behavioural transgressions.

All other correlations between parenting style and physical aggression were non-significant. However, at Time 1 the correlation between authoritative parenting and teacher ratings of the number of times per week physical aggression occurs did approach significance ($p = 0.074$). This finding suggests that children whose parents are more authoritative show a tendency towards being less likely to engage in physical aggression, at least as rated by teachers.

Regression Results (Hypotheses 1-5)

Assessment of the relative contributions of executive function and attachment. Of interest in the current study was whether and to what extent cognitive factors (vocabulary and executive function) and social-interaction factors (attachment, parenting styles) predicted parent and teacher reports of physical aggression. However, several of these variables were correlated with one another, and, as evidenced from correlational analyses, not all of these variables were strongly associated with physical aggression at the zero-order level. Executive function and attachment were found to be most consistently related to physical aggression in the current study. Accordingly, a series of hierarchical regression analyses were conducted in order to examine the relative and cumulative contributions of attachment and executive function in the prediction of physical aggression. These regressions were conducted concurrently for Time 1 (eight regressions) and for Time 2 (two regressions) data (see Appendix L for an overview table of all 10 regressions).

Prior to conducting the multiple regressions, a decision was made to remove Working Memory and Planning/Organizing from all of the regression analyses, as these two variables were highly correlated with other measures of executive function, as rated by both parents and teachers, at both Time 1 and Time 2 (see Tables 16-19), and were found to be less consistently correlated with physical aggression than the other subscales of executive function. The decision to exclude Working Memory and Planning/Organizing from the regression analyses allowed for a more parsimonious interpretation of results, minimized the possibility of suppression in regressions, and minimized multicollinearity.

The original intention was to conduct regression analyses using both parent and teacher data at both time points from Study 2. However, given the number of predictor variables to be included in each of the regressions, there were too few participants to run regressions using teacher data at Time 2 in order to attain a stable regression equation (Tabachnick & Fidell, 2007). Accordingly, only one pair of regressions was conducted at Time 2, using parent reports of physical aggression and executive function.

As was done for Study 1, the following series of regressions are reported in pairs. Specifically, a hierarchical regression where attachment is entered on Step 1 and the three indices of executive function (Inhibition, Shift and Emotional Control) on Step 2 is matched with a hierarchical regression where the executive function subscales are entered on Step 1 with attachment on Step 2. The overall R^2 (following Step 2) for both of these regressions is identical and provides an estimate of the cumulative effect of attachment and executive function. The changes (from Step 1 to Step 2) for each regression in a pair provide information on the relative effects of attachment and executive function by giving an R^2 change from the first to the second step.

Table 16

Bivariate Zero-Order Correlations Between T1 Teacher BRIEF - P Subscales

Measure	T1 Teacher Inhibit	T1 Teacher Shift	T1 Teacher Emotional Control	T1 Teacher Working Memory	T1 Teacher Planning/ Organizing
T1 Teacher Inhibit		**0.42****	**0.65****	**0.74****	**0.65****
T1 Teacher Shift			**0.72****	**0.45****	**0.52****
T1 Teacher EC				**0.46****	**0.50****
T1 Teacher WM					**0.84****
T1 Teacher P/O					
N	54	52	53	45	53

Note: All significant correlations are in bold and are marked by asterisks; df = 43 – 52;
* = $p < .05$, ** = $p < .01$.

Table 17

Bivariate Zero-Order Correlations Between T1 Parent BRIEF - P Subscales

Measure	T1 Parent Inhibit	T1 Parent Shift	T1 Parent Emotional Control	T1 Parent Working Memory	T1 Parent Planning/ Organizing
T1 Parent Inhibit		**0.46****	**0.71****	**0.74****	**0.79****
T1 Parent Shift			**0.58****	**0.36****	**0.37****
T1 Parent EC				**0.55****	**0.52****
T1 Parent WM					**0.82****
T1 Parent P/O					
N	44	46	46	45	43

Note: All significant correlations are in bold and are marked by asterisks; df = 41-44;
* = $p < .05$, ** = $p < .01$.

Table 18

Bivariate Zero-Order Correlations Between T2 Teacher BRIEF- P Subscales

Measure	T2 Teacher Inhibit	T2 Teacher Shift	T2 Teacher Emotional Control	T2 Teacher Working Memory	T2 Teacher Planning/ Organizing
T2 Teacher Inhibit		0.38	**0.66****	**0.76****	**0.72****
T2 Teacher Shift			**0.78****	**0.49***	**0.59****
T2 Teacher EC				**0.62****	**0.68****
T2 Teacher WM					**0.96****
T2 Teacher P/O					
N	21	20	22	22	22

Note: All significant correlations are in bold and are marked by asterisks; df = 18 – 20;
* = $p < .05$, ** = $p < .01$.

Table 19

Bivariate Zero-Order Correlations Between T2 Parent BRIEF - P Subscales

Measure	T2 Parent Inhibit	T2 Parent Shift	T2 Parent Emotional Control	T2 Parent Working Memory	T2 Parent Planning/ Organizing
T2 Parent Inhibit		**0.59****	**0.75****	**0.77****	**0.69****
T2 Parent Shift			**0.64****	**0.80****	**0.77****
T2 Parent EC				**0.59****	**0.65****
T2 Parent WM					**0.86****
T2 Parent P/O					
N	24	24	24	24	24

Note: All significant correlations are in bold and are marked by asterisks; df = 22;
* = $p < .05$, ** = $p < .01$.

Time 1 parent reported physical aggression predicted by attachment and parent reports of executive function. In the first regression equation, parent-reported physical aggression was the criterion variable, Time 1 Attachment was entered on Step 1, and Time 1 Parent Inhibit, Parent Shift and Parent Emotional Control were entered on Step 2. By itself, Attachment was found to significantly predict physical aggression on Step 1, $R^2 = 0.18$, Adjusted $R^2 = 0.16$, F (1, 36) = 7.94, $p = 0.008$. The parent-reported executive function variables were not found to predict a significant amount of variance in physical aggression, over and above that accounted for by Attachment, although the finding did approach significance, R^2-*Change* = 0.15, *F-Change* (3, 33) = 2.54, $p = 0.07$. This finding may have been significant with a higher sample size, and greater power. An estimate of the cumulative amount of variance in parent-reported physical aggression accounted for by executive functioning along with the attachment measure can be estimated when all variables were included in the equation, $R^2 = 0.33$, Adjusted $R^2 = 0.25$, F (3, 33) = 4.14, $p = 0.008$.

In a second regression equation, Time 1 parent-reported physical aggression served as the criterion variable, with the blocks of predictors reversed so that Time 1 Parent Inhibit, Shift and Emotional Control were entered on Step 1 and Time 1 Attachment was entered on Step 2. In this equation, the executive function variables were found to be significantly predictive of physical aggression, $R^2 = 0.33$, Adjusted $R^2 = 0.27$, F (3, 34) = 5.52, $p = 0.003$, while Attachment did not significantly predict physical aggression over above the amount of variance accounted for by executive function skills, R^2-*Change* = 0.01, *F-Change* (1, 33) = 0.33, $p = 0.57$.

In each of these two analyses, Inhibition was the only variable that emerged as being uniquely predictive of physical aggression when all variables were in the equation, $\beta = 0.52$, t

(35) = 2.19, $p = 0.04$. This suggests that more physical aggression, as reported by parents at Time 1, could be predicted from poorer inhibition skills, as reported by parents.

Time 1 teacher reported physical aggression predicted by attachment and teacher reports of executive function. In the first regression equation of this second pair of regressions, Time 1 teacher reports of physical aggression served as the dependent variable, while Time 1 Attachment was entered on Step 1, and Time 1 teacher reports of Inhibit, Shift and Emotional Control were entered on Step 2. Attachment was found to significantly predict physical aggression scores in this equation, $R^2 = 0.23$, Adjusted $R^2 = 0.20$, F (1, 25) = 7.42, $p = 0.01$. On Step 2, the executive function variables also significantly predicted physical aggression, over and above the amount of variance accounted for by attachment, R^2-*Change* = 0.49, *F-Change* (3, 22) = 12.83, $p < 0.001$. When taken together as a cumulative estimate, attachment and teacher-reported executive function accounted for nearly three quarters of the variance in teacher-reported physical aggression, $R^2 = 0.72$, Adjusted $R^2 = 0.67$, F (3, 22) = 14.11, $p < 0.001$.

When Step 1 and 2 were flipped, and the executive function variables were entered into the regression equation first, they were again found to significantly predict physical aggression, $R^2 = 0.69$, Adjusted $R^2 = 0.64$, F (3, 23) = 16.67, $p < 0.001$. On Step 2, Attachment was not found to predict teacher ratings of physical aggression over and above the effect of executive function, R^2-*Change* = 0.11, *F-Change* (1, 22) = 2.72, $p = 0.11$.

In this pair of regressions, Emotional Control was the only variable that emerged as being uniquely predictive of physical aggression when the effects of other predictors were controlled, $\beta = 0.78$, t (24) = 3.99, $p = 0.001$. This suggests that more physical aggression, as reported by teachers at Time 1, could be predicted from poorer emotional control skills, as reported by teachers.

Time 1 parent-reported physical aggression predicted by attachment and teacher reports of executive function. In the sixth regression equation, Time 1 parent-reported physical aggression served as the criterion variable, Time 1 Attachment (as reported by parents) was entered on Step 1, and Time 1 Teacher Inhibit, Teacher Shift and Teacher Emotional Control were entered on Step 2. By using this order, it was possible to assess the relative contribution of Attachment in the prediction of physical aggression and examine the change in R^2 when the three indices of executive function were added to the equation. By itself on Step 1, Attachment was found to significantly predict physical aggression, $R^2 = 0.22$, Adjusted $R^2 = 0.19$, F (1, 25) = 6.97, $p = 0.01$. Moreover, the addition of teacher reports of Inhibition, Shift and Emotional Control accounted for a significant amount of variance in physical aggression over and above that accounted for by Attachment alone, R^2-*Change* = 0.25, *F-Change* (3, 22) = 3.40, $p = 0.04$. Finally, an estimate of the cumulative amount of variance in parent-reported physical aggression accounted for by executive functioning along with the attachment measure on physical aggression was estimated when all variables were included in the equation together, $R^2 = 0.47$, Adjusted $R^2 = 0.37$, F (4, 22) = 4.80, $p = 0.01$.

In a second regression equation the hierarchical entry of vocabulary and executive functioning was reversed. Time 1 parent-reported physical aggression served as the criterion variable, Time 1 Teacher Inhibit, Shift and Emotional Control were entered on Step 1 and Time 1 Attachment was entered on Step 2. In Step 1, the Executive Function variables were found to be significantly predictive of physical aggression, $R^2 = 0.41$, Adjusted $R^2 = 0.33$, F (3, 23) = 5.28, $p = 0.01$.

Attachment added relatively little to the prediction of physical aggression on Step 2, and was not significant over and above the variance accounted for by Executive Function, R^2-*Change*

= 0.06, *F-Change* (1, 22) = 2.39, $p = 0.14$. In each of the above two regression analyses, Emotional Control was the only variable which significantly accounted for a unique proportion of the variance in physical aggression when all predictors were in the equation. Specifically, more difficulties with teacher-reported Emotional Control were associated with higher levels of parent-reported physical aggression, $\beta = 0.67$, t (24) = 2.47, $p = 0.02$.

Time 1 teacher reported physical aggression predicted by attachment and parent reports of executive function. In a seventh regression equation, Time 1 teacher reports of physical aggression was the criterion, predicted by Time 1 attachment on Step 1 and Time 1 parent ratings of executive function on Step 2. By itself, Attachment was found to significantly predict physical aggression, $R^2 = 0.21$, Adjusted $R^2 = 0.18$, F (1, 25) = 6.76, $p = 0.02$. The addition of executive function on Step 2 did not account for a significant amount of variance in physical aggression over and above that accounted for by Attachment, R^2-*Change* = 0.03, *F-Change* (3, 22) = 0.31, $p = 0.82$. When all of the variables were entered into the equation together, an estimate of the cumulative effect of parent-reported executive function and attachment on teacher ratings of physical aggression is provided. This yielded a higher R^2 value than when attachment was the only predictor variable, however, all of the variables together did not significantly predict physical aggression, $R^2 = 0.24$, Adjusted $R^2 = 0.11$, F (4, 22) = 1.78, p = 0.17. This may have been due to a lack of power given the small sample size for this analysis and given that power decreases as the number of predictor variables in the equation increases.

In the eighth regression equation, Time 1 teacher reports of physical aggression once again served as the criterion, while Time 1 parent ratings of executive function were entered on Step 1, and Time 1 attachment was entered on Step 2. In this equation neither Step 1, $R^2 = 0.19$, Adjusted $R^2 = 0.09$, F (3, 23) = 1.82, $p = 0.17$ nor Step 2, R^2-*Change* = 0.05, *F-Change* (1, 22) =

1.53, $p = 0.23$ were significant. Neither of these two regression analyses revealed any variables that were uniquely predictive of Time 1 teacher reports of physical aggression when all of the predictor variables were entered into the equation together.

Time 2 parent reported physical aggression predicted by attachment and parent reports of executive function. As was the case with parent data at Time 1, Attachment was once again found to significantly predict physical aggression on Step 1 at this time point, $R^2 = 0.19$, Adjusted $R^2 = 0.15$ F (1, 20) = 4.83, $p = 0.04$. Similarly, consistent with Time 1 findings, parent-rated Inhibition, Shift and Emotional Control did not add significantly to the prediction of parent-rated CBS scores at Time 2, R^2-*Change* = 0.21, *F-Change* (3, 17) = 2.05, $p = 0.14$. However, given the magnitude of the R^2-*Change* value this finding may have been significant with a higher sample size and greater power. An estimate of the cumulative amount of variance in parent-reported physical aggression at Time 2 accounted for by executive functioning along with attachment can be estimated when all variables were included in the equation, $R^2 = 0.409$, Adjusted $R^2 = 0.27$, F (4, 17) = 2.94, $p = 0.05$.

In a second regression equation at Time 2, parent ratings of Inhibition, Shift and Emotional Control were entered on Step 1, and Attachment was entered on Step 2. The linear combination of the executive function scales was found to significantly predict parent-rated physical aggression, $R^2 = 0.39$, Adjusted $R^2 = 0.29$, F (3, 18) = 3.90, $p = 0.03$, while Attachment did not significantly predict physical aggression over above the amount of variance accounted for by executive function skills, R^2-*Change* = 0.02, *F-Change* (1, 17) = 0.42, $p = 0.52$.

Inhibition was the only variable in this pair of regressions found to independently predict physical aggression scores, $\beta = 0.74$, t (19) = 2.41, $p = 0.03$. The direction of this finding once

again points to greater problems with Inhibition predicting higher levels of physical aggression, as reported by parents.

Assessment of variance accounted for by multiple risk factors. Of additional interest, was the amount of variance in physical aggression that could be accounted for by the linear combination of all of the predictors in Study 2 that yielded some significant bivariate relationships with physical aggression. Included in these simple regressions were Inhibition, Shift, Emotional Control, Attachment and Authoritarian Parenting. A series of four simple regressions were conducted to this end at Time 1; the sample at Time 2 was not sufficiently large to support these analyses.

Time 1 parent-reported physical aggression predicted by attachment, authoritarian parenting and parent reports of executive functioning. In the first regression equation in this series, the combination of Attachment, Authoritarian parenting and parent reported Inhibition, Shift and Emotional Control skills marginally significantly predicted parent reports of physical aggression, $R^2 = 0.34$, Adjusted $R^2 = 0.24$, F (5, 35) = 3.60, $p = 0.10$. Inhibition was the only significant individual predictor, $\beta = 0.49$, t (39) = 2.25, $p = 0.03$ in the presence of the other variables.

Time 1 teacher-reported physical aggression predicted by attachment, authoritarian parenting and teacher reports of executive functioning. In this second regression equation, the combination of Attachment, Authoritarian parenting and teacher-reported Inhibition, Shift and Emotional Control were significantly predictive of teacher-reported physical aggression scores, $R^2 = 0.73$, Adjusted $R^2 = 0.67$, F (5, 24) = 12.90, $p < 0.001$, accounting for a large percentage of the variance in physical aggression scores. In this equation, Emotional Control emerged as the only unique predictor of physical aggression, $\beta = 0.75$, t *(28*) = 3.61, $p = 0.001$.

Time 1 parent-reported physical aggression predicted by attachment, authoritarian parenting and teacher reports of executive functioning. In this model, Time 1 parent reports of physical aggression (CBS) were predicted by teacher reports of Inhibition, Shift, and Emotional Control skills, parents' scores on the measure of authoritarian parenting, and parent reports of their child's attachment difficulties. Together, these variables were not found to significantly predict physical aggression, $R^2 = 0.28$, F (5, 24) = 1.84, $p = 0.14$. Given the small sample size, however, Adjusted R^2 is likely a more accurate reflection of the proportion of the variance in physical aggression accounted for by this model, Adjusted $R^2 = 0.13$.

Time 1 teacher-reported physical aggression predicted by attachment, authoritarian parenting and parent reports of executive functioning. In this regression Attachment, Authoritarian parenting and parent reports of Inhibition, Shift and Emotional Control were not found to significantly predict teacher-reported physical aggression scores, $R^2 = 0.284$, Adjusted $R^2 = 0.13$, F (5, 24) = 1.90, $p = 0.13$.

Mediation Testing (Hypothesis 6)

The four-step approach outlined by Baron and Kenny (1986) was used to test the hypothesis that Attachment would mediate the relationships between parenting styles and physical aggression. According to this method, the first condition that must be met in order for a variable to be considered a mediator is that the predictor (in this case parenting styles) must be significantly associated with the criterion variable (in this case physical aggression). As stated above, Authoritarian parenting was the only style of parenting found to relate significantly to physical aggression (specifically parent-reported CBS physical aggression; r (45) = 0.28, p = 0.03 at Time 1 and r (21) = 0. 36, $p = 0.48$ at Time 2). The second step involves showing that a significant relationship exists between the predictor (authoritarian parenting) and the proposed

mediator (attachment difficulties). A significant positive correlation was found between Authoritarian parenting and Attachment difficulties at Time 1, r (43) = 0.45, p = 0.001 and Time 2, r (20) = 0.76, $p < 0.001$ (see Appendix M for an overview of all other correlations between attachment and parenting styles). The direction of these findings suggests that higher authoritarianism is associated with more attachment difficulties. Steps three and four of Baron and Kenny's (1986) approach are assessed through a standard regression analysis. The proposed mediator must be significantly associated with the dependent variable, and finally, the relationship between the predictor and the dependent variable must decrease after controlling for the proposed mediator variable. When the relationship between the predictor and the criterion is reduced to a non-significant level, this is considered full mediation.

At Time 1 of the present study, a regression analysis showed that attachment was predictive of parent-rated physical aggression on the CBS, even after controlling for Authoritarianism (one-tailed), β = 0.21, t (42) = 1.81, p = 0.04, while the relationship between Authoritarian parenting and physical aggression was reduced to a non-significant level once Attachment difficulties had been accounted for, β = 0.02, t (42) = 1.18, p = 0.12. Kenny (2009) states that the Sobel formula can be used to test the significance of the decrease in the statistical relationship between Authoritarian parenting and physical aggression once the proposed mediator has been accounted for. Using a one-tailed Sobel test, this reduction was found to be marginally significant (p = 0.06), suggesting that attachment mediates the relationship between Authoritarian parenting and parent-rated physical aggression scores at Time 1.

At Time 2, Attachment did not predict parent-rated physical aggression once authoritarian parenting had been accounted for, β = 0.28, t (19) = 1.27, p = 0.01. Similarly, a Sobel calculation did not find that the relationship between authoritarian parenting and physical

aggression significantly decreased once Attachment has been accounted for, $p = 0.109$, one-tailed. Accordingly, attachment cannot be said to have mediated the relationship between authoritarian parenting and physical aggression at Time 2.

Change Over Time

It was hypothesized that gains in language and executive function skills would be associated with decreases in physical aggression. It was expected that children who showed large increases in these skills during the course of one year would show proportionally greater decreases in physical aggression. Although it was expected that decreases in attachment problems, authoritarian and permissive parenting, and increases in authoritative parenting would likewise be associated with decreases in physical aggression over time, no specific hypotheses were made regarding changes in these predictor variables. This is because it was presumed that there would be relatively less individual variation across time on measures of attachment and parenting style. Children's rank order scores on these variables (their attachment and parenting style scores relative to peers in the sample) was expected to remain relatively consistent across the two time points of the study. If this was the case it would limit the variability in difference scores and yield non-significant correlations with physical aggression difference scores. Similarly, there was no requirement made that the same parent report on their child at both time points; consequently, attachment and parenting styles may have varied as a function of change over time, but might also have varied as a function of different raters.

Difference scores were calculated for all of the variables in the current study. This allowed for a longitudinal comparison of whether and how changes in physical aggression were associated with changes in each of the predictor variables (i.e., language, executive function, attachment and parenting styles) over the course of the year. For all of these variables, scores at

Time 1 were subtracted from scores at Time 2. Consequently, a negative difference score for physical aggression indicates a decrease in this behaviour over time; a negative difference score on either receptive or expressive language indicates a decrease in language skills over time; a negative difference score for any of the executive function domains indicates gains in executive abilities over time (i.e., less executive dysfunction at Time 2); a negative score for parenting style indicates that the reporting parent ascribed less to that particular style of parenting during the second phase of data collection than did the reporting parent at Time 1; and a negative difference score for attachment is indicative of improved attachment relations over time (i.e., fewer attachment difficulties at Time 2).

Correlations were conducted for difference scores across the four of the measures of physical aggression (parent-reported CBS, teacher-reported CBS, parent-reported times per week and teacher-reported times per week) and each of the predictor variables. Participant inclusion in these analyses required that a participant have data at both time points, for both of the variables being correlated. Unfortunately, this requirement greatly limited the sample size for these analyses. Accordingly, the results of these analyses should be interpreted with caution. Given the degree to which the sample was restricted for these analyses, all of the variables were re-screened for skewness and outliers in order to minimize any violations of the normality assumption. No transformations were deemed necessary. However, using the Windsor procedure (Howell, 2002), two outliers were brought in to the distribution for the parent and teacher times per week measure.

The small sample size of these analyses also calls into question the generalizability of the change over time correlation results. Accordingly, one-sample t-tests were conducted to test whether sample means on each of the variables of interest for the participants included in the

change over time analyses differed significantly from the sample as a whole at Time 1. One sample t-tests are designed to assess whether the mean of a small ($n < 30$) sample differs significantly from a known population mean. Accordingly, Time 1 means yielded by smaller sample of individuals included in the change over time analyses were compared against mean scores for the entire sample at Time 1. A significant difference was found for teacher reports on the times per week measure at Time 1, whereby the mean number of physically aggressive acts committed by children in the sample included in the change over time analyses was significantly less than the sample as a whole at Time 1, $t\ (16) = -7.44$, $p < 0.001$. Accordingly, correlations involving this variable likely do not reflect the sample as a whole. Those correlations are nevertheless reported below and should be interpreted with a high degree of caution. All other one-sample t-tests yielded non-significant results, suggesting that the smaller sample of participants included in the following change over time correlations had scores on each of the measures of interest which reflected the sample as a whole at Time 1.

Finally, due to the sample size, the power to detect significant correlations among the change over time analyses is low. For this reason, and given the strong theoretical and previous statistical support for the hypotheses surrounding these results, one-tailed correlational analyses were deemed appropriate. However, this limits the interpretation of significant findings to those that were found to be in the expected direction. Although no significant relations were hypothesized regarding attachment and parenting style, the direction of the relationships between changes in physical aggression and these variables only make theoretical sense in one direction. Accordingly, one-tailed test were employed with these variables as well.

Several significant findings did emerge (see Table 20). Parent-reported CBS difference scores were found to correlate significantly with parent-reported Shift, and both teacher and

Table 20

Study 2 T2-T1 Difference Score Correlations

Measure	Teacher CBS Aggression Difference Score	Parent CBS Aggression Difference Score	Teacher Times per Week Aggression Difference Score	Parent Times per Week Aggression Difference Score
Diff. Receptive	0.03	0.19	0.10	-0.16
Diff. Expressive	0.46	0.21	0.30	-0.15
Diff. Teacher Inhibit	**0.56****	0.44	**0.48***	0.20
Diff. Teacher Shift	0.24	0.46	**0.57***	0.01
Diff. Teacher EC	**0.63****	**0.84****	**0.51***	0.44
Diff. Teacher WM	0.26	0.29	0.19	-0.12
Diff. Teacher PO	0.26	0.40	0.29	-0.08
Diff. Parent Inhibit	0.43	0.24	0.30	0.21
Diff. Parent Shift	0.44	**0.60****	0.44	**0.52***
Diff. Parent EC	0.12	**0.52****	-0.38	**0.58***
Diff. Parent WM	0.33	0.19	0.44	**0.56***
Diff. Parent PO	-0.13	0.15	0.16	0.25
Diff. Attachment	-0.39	0.33	-0.46	**0.77****
Diff. Authoritarian	-0.04	0.18	-0.07	-0.14
Diff. Permissive	-0.12	0.32	-0.17	0.23
Diff. Authoritative	0.74	-0.10	0.30	-0.14
Variable Mean	0.26	-0.08	0.66	-0.37
Variable *SD*	0.79	0.42	2.29	0.87
N	19	21	17	13

Note: All significant correlations are in bold and are marked by asterisks; df = 11 – 19; * = $p < .05$, ** = $p < .01$.

parent-reported Emotional Control difference scores, while teacher-reported CBS difference scores were found to correlate significantly with teacher-reported Inhibition and Emotional Control difference scores. The direction of these relationships suggests that gains in these executive function skills were associated with decreases in physical aggression over time. Similarly, using the more longitudinally sensitive times per week measure of physical aggression, difference scores for parent reports were found to correlate significantly with parent-reported attachment scores (such that an increase in attachment difficulties corresponded with an increase in physical aggression over time), as well as parent reports of shift, emotional control, and working memory skills (such that an increase in executive dysfunction was associated with an increase in aggression). The difference scores of teacher reports on this measure of physical aggression correlated significantly with the difference scores on teacher ratings of inhibition, shift and emotional control skills. Once again, in each of these cases, the directions of these results suggest that gains in these respective executive domains were associated with decreases in physical aggression over the course of a year.

Study 2 Discussion

As was done for Study 1, a brief discussion of the results from Study 2 will now be provided. A more extensive discussion of the implications of both studies together will follow in the General Discussion section. Table 21 presents a summary of Study 2 findings with specific reference to whether hypotheses were supported or not.

As was found in Study 1, longitudinal analyses revealed that there was very little change in physical aggression scores over the two time points. This finding is inconsistent with past research (e.g., Arsenio, 2004a; Cote et al., 2007; Cote et al., 2006; Gauthier, 2003; Tremblay, 2000; Tremblay, 2001) suggesting that declines in physical aggression typically occur during the

Table 21

Summary of Study 2 Findings

Hypotheses	Findings
1. Higher scores for expressive vocabulary will be associated with and predictive of lower physical aggression (concurrently).	**Hypothesis was marginally supported**
2. Higher scores of receptive vocabulary will be associated with and predictive of lower physical aggression (concurrently).	**Hypothesis was marginally supported.**
3. Higher scores on executive function (which are indicative of dysfunction) will be associated with and predictive of higher scores of physical aggression (concurrently).	**Hypothesis was generally supported.**
4. Greater difficulties with attachment will be associated with and predictive of higher physical aggression (concurrently).	**Hypothesis was generally supported.**
5. Higher levels of both Authoritarian and Permissive parenting will be associated with and predictive of higher physical aggression, while higher levels of Authoritative parenting will be associated with lower scores of physical aggression (concurrently)	**Hypothesis was partially supported**.
6. Attachment will mediate the relationships between parenting styles and physical aggression	**Hypothesis was partially supported.**
7. Gains in expressive and/or receptive vocabulary over a one year period will be associated with decreases in physical aggression over this same time period.	**Hypothesis was not supported.**
8. Declines in executive dysfunction (i.e., improvement) over a one year period would be associated with decreases in physical aggression over this same time period.	**Hypothesis was partially supported.**

preschool years. As with Study 1, however, the CBS measure may have been too subjective and not sensitive enough to assess longitudinal changes, as participants' definition of "never", "sometimes", and "often" may have changed over the course of the year (coinciding with developmentally appropriate expectations for aggressive behaviour). This is one reason why additional measures of physical aggression (such as the times per week measure) were incorporated into Study 2. Decreases in physical aggression did occur from Time 1 to Time 2 using the times per week measure, however this finding was not significant, possibly due to the small sample size at Time 2 and limited power to detect a significant finding.

Measure of Physical Aggression (CBS)

Considerable overlap was found between all four of the items measuring physical aggression in Study 2, including the traditional subjective frequency ratings (never, sometimes, always), a measure of times per week, a relative comparison question and an index of the extent of respondents' worry. A high correlation between the CBS and the times per week ratings of physically aggressive incidents suggests that the CBS does seem to accurately reflect children's quantitative frequency of physical aggression. However, the high correlations between the CBS and both respondents' comparison of the child's behaviour to peers, and their own degree of worry about the child's behaviour, suggests that the CBS may be tapping into more than just the frequency of aggression. Responses on the CBS may also reflect what the respondent believes to be a developmentally normal amount of aggression for the child as well as respondents' emotions about the child's aggression (in particular how much they worry about it). This interpretation was further supported by simple regression analyses which showed that the linear combination of the items about children's levels of aggression compared to peers, and

respondents' level of worry about the child's aggression accounted for a high degree of the variance in responses to the CBS measure.

The fact that teacher CBS ratings were more strongly predicted by their perception of the child's physical aggression relative to peers and their level of worry about this behaviour may reflect teachers having a more consistent view or perhaps even a more accurate baseline for what constitutes a developmentally normal amount of aggression. Teachers may then worry about a child in accordance with the degree to which they feel the typical level of aggression has been exceeded. This would make sense given their area of expertise and level of exposure to a broad variety of children. According to parents, other than the child they reported on, the mean number of siblings in their home was 0.59, suggesting perhaps a limited amount of exposure to children. However, it should be noted that both parents and teachers did show significant overlap among all four of the different ways that physical aggression was measured in the current study, although there was less agreement in the identification of children who were reported to show above-average levels of physical aggression.

Lastly, no significant correlation was found between teacher CBS ratings of physical aggression and parents' degree of worry about their child's aggression. This finding suggests that although worried parents report that they see more physical aggression from their children, these children do not necessarily show a high level of aggression at their daycare. It is possible that these children are actually less aggressive at daycare, but perhaps more plausibly, this may suggest that more worried parents show a confirmation bias and may actually be reporting their children to be more aggressive than they actually are. It could be that a parent's level of worry confounds their responses on the CBS. This suggests that the CBS cannot be taken as an ideally

objective measure of physical aggression and highlights the importance of utilizing multiple raters when assessing a child's level of physical aggression (DiGiunta et al., 2010).

The reliabilities of the physical aggression measures were consistently high when teacher-ratings were employed. It seemed that no matter how teachers were asked about a child's level of physical aggression, the items went together quite well. When parents were rating, however, the internal consistencies for some of the measures (particularly the CBS and times per week measures) were found to be fairly low (i.e., 0.58-0.63). This degree of measurement error leads to attenuated effect size magnitudes in correlational analyzes (Pedhazur, 1982) and as such the results reported herein that involve these parent ratings may in fact be underestimates of the actual connections.

The reason why some variables (e.g., receptive and expressive vocabulary) may have correlated with the times per week measure and not the CBS measure of physical aggression may relate to there being more variability in responses on the times per week measure. In order to increase the internal consistency in measuring physical aggression, it may be of interest for future researchers to add additional items to the measurement of physical aggression. This could include items that assess different forms of physically aggressive behaviour besides kicking, biting, hitting, fighting and reacting with anger. Another way of aiding the precision of measurement would be to ask the questions differently, rather than in just a relatively subjective manner as is the case with the CBS (e.g., through the use of the word "many" when quantifying physical aggression). The current research has demonstrated and begun to explore some alternative ways to ask respondents about physical aggression (i.e., times per week, comparison to same-aged peers, and level of respondent worry about physically aggressive behaviour), however future research will be needed in order to assess the merits of these efforts and to

further improve the measurement of physical aggression as the current findings suggest that the three items that make up the CBS measure may not be optimal, particularly with preschool children.

The Connection Between Vocabulary and Physical Aggression

The hypotheses that better expressive and receptive vocabulary skills would be associated with lower physical aggression were marginally supported by the results of this study. Small significant correlations were found between expressive vocabulary and open-ended teacher reports of physical aggression times per week, and between receptive vocabulary and both parent and teacher reports on the times per week measure of physical aggression. No association was found between either expressive or receptive vocabulary and the CBS measure of aggression, however. Since this was the criterion measure in the regression analyses (in order to make results comparable to Study 1), neither receptive nor expressive vocabulary were included in any of the regression analyses for this study.

These results are somewhat surprising given the extant literature supporting the existence of a relationship between physical aggression and language skills (e.g., Dionne et al., 2003; Hughes & Ensor, 2006). The limited support for this connection in the current research may have been a function of both a restricted sample size, as well as the aforementioned limitations concerning the measurement of physical aggression (i.e., the CBS) in the current study. These same limitations were present when assessing all of the Study 1 hypotheses, however. The fact that language in particular was not found to be strongly related to physical aggression in the current research may suggest that this link is relatively less robust than the association between physical aggression and some of the other variables of interest in the current study.

The Connection Between Executive Function and Physical Aggression

The hypothesis that better executive function skills would be associated with lower physical aggression was generally supported by the results of this study. With the exception of parent-rated working memory and planning/organizing skills at both time points and Time 2 parent-rated shift scores, correlational findings suggested significant relations between the executive function subscales and the various indices of physical aggression. Moreover, the combination of inhibition, shift and emotional control were found to be predictive of physical aggression at Time 1, except when teacher reports of physical aggression were predicted from parent reports of executive function. Teacher reports of executive function were also found to be predictive of both parent and teacher reports of physical aggression over and above the variance accounted for by children's attachment difficulties. In one equation, inhibition was found to predict a significant unique proportion of the variance in physical aggression scores and in two other equations emotional control emerged as a significant unique predictor.

The second series of regressions (those designed to assess the cumulative proportion of variance in physical aggression that could be accounted for in this study by multiple risk factors) also seemed to highlight that inhibition and emotional control are key executive functioning domains implicated in physical aggression. However, significant findings were only obtained for these analyses when the same individual rated both physical aggression and inhibition (i.e., both were either teacher reports or both were parent reports). Analyses involving a cross-over of raters (e.g., parent reports for the criterion variable and teacher reports of the predictors) were not found to be significant. This may be due to shared method variance. Specifically, respondents' ratings on both the CBS and BRIEF-P may reflect an overall view or bias they hold about the child. Accordingly, it is important to remember that the current findings allow for the prediction

of *reported* physical aggression, which may not always completely reflect children's actual levels of physical aggression. In all, the finding that aggressive behaviour appears to be associated with executive dysfunction is supported by past research (e.g., Dodge et al., 2006; Hughes, Dunn & White, 1998; Hughes & Ensor, 2006; Moffitt, 1993; Raaijmakers et al., 2008; Seguin & Zelazo, 2005), including Study 1. However, much of this research has involved more general measures, such as behaviour problems (e.g., Hughes and Ensor, 2006) and delinquency (e.g., Moffitt 1990; 1993), while the current research focused more specifically on physical aggression. Moreover, the current research also expanded on past literature and theory (e.g., Zelazo et al., 1997) by pointing to inhibition in particular as possibly driving the relationship between physical aggression and executive function. The implications of these findings will be discussed in the General Discussion section.

The Connection Between Attachment and Physical Aggression

In light of correlational findings, the hypothesis that greater attachment difficulties would be associated with more physical aggression among children was generally supported by the present study. This result is consistent with previous research (e.g., Baron & Richardson, 1994; Marcus & Kramer, 2001; Moss et al., 2006; Lyons-Ruth, Alpern & Repacholi, 1993; Renken et al., 1989; Shaw et al., 1994). However, attachment was not significantly predictive of physical aggression after controlling for certain executive function skills (Inhibition, Shift and Emotional Control). This suggests that while attachment is a relevant predictor of physical aggression, it does not add significantly to the prediction of physical aggression when these executive function scores are known, and therefore inhibition, shift and emotional control may be more pertinent to the prediction of physical aggression. This posits the possibility that a more direct link may exist between these executive function skills and physical aggression; this could be an area for future

research if this finding were to be replicated with a larger sample. However, it is important to keep in mind that the finding was obtained with a relatively small sample of children, and perhaps with a larger sample, and more power, attachment would add significantly to the prediction of physical aggression over and above the variance accounted for by executive function.

The Connection Between Parenting Styles and Physical Aggression

The hypothesis that higher levels of authoritarian parenting would be associated with higher physical aggression was largely unsupported by the current research. At Time 1, parents who rated themselves as having a more authoritarian style were more likely to report higher physical aggression scores for their children (using the CBS). This finding was expected given previous research findings which showed links between authoritarian parenting and aggressive behavior among children (e.g., Baumrind, 1971; Eron & Huesmann, 1984). This may be related to Baumrind's (1967, 1971) explanation that children reared in an authoritarian environment experience poorer behavioural outcomes as a result of parents' difficulties with emotion regulation and self-control, which she viewed as crucial in order for successful parenting to occur (Palmer 2009).

No connection was found between an authoritarian style of parenting and teachers' ratings of children's physical aggression, however. Similarly, using the times per week measure of how often children aggress physically, no significant relation between authoritarianism and physical aggression emerged. This suggests that children who have more authoritarian parents may not actually *be* more aggressive, but rather, compared to parents who report a less authoritarian parenting style, their parents *perceive* their acts of physical aggression as more problematic or worrisome. Authoritarian parents may have stricter developmental expectations

for how much aggression constitutes considered "many" episodes, and therefore report more physical aggression from their child on the CBS measure, even though their child may be less aggressive as compared to another child. This interpretation is consistent with Baumrind's (1971; 1991) belief that parents with a more authoritarian style of parenting tend to value obedience more highly than other parents. Similarly, this interpretation fits with the finding that more authoritarian parents also reported worrying more about their children's level of physical aggression (albeit at a marginally significant level). It may be that this style of parenting is associated with less tolerance for physical aggression. This would explain the finding that more authoritarian parents reported their children to be more physically aggressive on the relatively subjective CBS measure of physical aggression (e.g., "how often would you say your child gets into many fights: never or not true; sometimes or somewhat true; often or very true?"), but not when asked to estimate the actual number of physically aggressive acts the child engages in per week.

In terms of the clinical implications of this finding, having information about parenting style may not necessarily help to predict a child's level of actual physical aggression. However, this information might help to guide a clinician towards a prediction of how accurate a parent's evaluation of the child's level of aggression may be. In the case of parents who report a high level of authoritarianism, it may be beneficial to use a more objective measure of physical aggression than the CBS, and/or to cross-reference a parent's report about their child's level of physical aggression with information from another source, such as a teacher or daycare provider (Palmer, 2009).

The hypotheses that higher levels of permissive parenting would be associated with higher physical aggression whereas higher levels of authoritative parenting would be associated

with lower levels of physical aggression were not supported by the current research. No significant relationships were found between the use of these parenting styles and physical aggression scores. Accordingly, these variables were not included in subsequent regression analyses. In future research, the employment of a parenting measure which categorizes participants into specific groups of parenting styles could examine how levels of physical aggression differ when parenting is compared across the primary or most common style used by parents. This would allow for a more comprehensive and clearer picture of how parenting style is related to children's physical aggression, in part by better controlling for response bias (i.e., parents who because of their response style scored either high or low on all parenting style scales).

The apparent lack of a strong, consistent association between physical aggression and parenting style may have implications for intervention efforts for highly physically aggressive children. It would seem to suggest that intervention efforts aimed at targeting physical aggression among preschoolers may be better to address other areas, such as executive skills or attachment. It should be noted that the current research did not specifically address intervention, nor did it involve a clinical sample of children, however. Similarly, as stated above, a different measure of parenting style, with a larger sample, may have yielded a more consistent link with physical aggression.

Attachment as a Mediator Between Parenting Styles and Physical Aggression

It was hypothesized that attachment would mediate the relationship between parenting styles and physical aggression. Specifically, it was thought that parenting may impact attachment as unresponsiveness would lead to a poorer attachment relationship (Shaw et al., 1994), and that attachment would in turn directly impact the development of physically aggressive behaviour.

This hypothesis was partially supported. Attachment was not found to mediate relationships between authoritative parenting and physical aggression, nor between permissive parenting and physical aggression, as no direct link existed between physical aggression and these first two styles of parenting. However, using a relatively liberal test of mediation due to the size of the sample (one-tailed, $p = 0.057$) attachment was found to fully mediate the relationship between the use of authoritarian parenting and parent-reported physical aggression (measured by the CBS) at Time 1, but not at Time 2. This suggests that attachment is the mechanism through which authoritarian parenting and physical aggression are connected. Given these results, it seems plausible that one developmental pathway which in part would explain some children's expression of physical aggression pertains to authoritarian parenting impacting attachment, which in turn directly impacts the development of physically aggressive behaviour. Based on the current findings it appears unlikely that authoritarian parenting has any direct relationship with or influence on physical aggression for the majority of children.

Given the abundance of previous literature that supports there being a connection between different parenting styles and aggression (e.g., Bandura, 1973; Baumrind, 1971; Eron & Huesmann, 1984; Olweus, 1980, Patterson et al., 1989), future research is merited to further assess the potential mediating role of attachment. A larger sample size would allow for a more powerful assessment of the mediation hypothesis. In other words, based on the limitations of the present findings, it is not possible to rule out that other parenting styles may be associated with physical aggression, or that attachment may or may not mediate other relationships between parenting style and physical aggression. While only limited support for the mediation hypothesis was found in the current research, this question warrants further consideration.

Change Over Time: Physical Aggression, Vocabulary and Executive Function

As was hypothesized, gains in certain aspects of executive function were associated with decreases in physical aggression over the year in which this study took place. Most notably, gains in preschooler's ability to inhibit, shift attention and retain emotional control were all found to relate to decreases in physical aggression. Gains in working memory skills were also linked to decreases in physical aggression, but only when parent reports on the times per week measure of physical aggression were employed and not when the more traditional CBS measure was examined. Similarly, when consideration was given to reports of the number of times per week children were physically aggressive, decreases in physical aggression were also related to a reduction in attachment difficulties over the same period. This finding is difficult to interpret, however, as no requirements were made that the same parent rate children's attachment at both time points in the study. Accordingly, it cannot be concluded that variation in attachment scores across the two time points necessarily reflect a true change in a child's attachment relationship with a single caregiver. Gains in vocabulary skills were not found to relate significantly to decreases in physical aggression, however, suggesting that vocabulary skills may not play as prominent of a role in the reduction of physical aggression over one year, at least at this age. Indeed, during the 22-55 month age period of the present sample, when most children do begin to show marked decreases in physical aggression (potentially as a result of there being a sensitive period contained within this age range; Tremblay, 2000; Tremblay, 2001), changes in physical aggression seem to be most consistently tied to changes in executive functioning, particularly in the domains of inhibition, shift and emotional control. This finding is novel, as previous literature has not compared the relative strength of various domains of executive function in the prediction of physical aggression. Given the age of the current sample it is possible that these are

domains which develop especially early or are more easily measured at this stage of development; this has previously been thought to be the case with inhibition skills in particular (Raaijmakers et al., 2008). It may also be that the capacity to inhibit, shift attention and control emotions may actually be more relevant to physical aggression. Although the current research is unable to assess causal relations, if executive function did influence the expression of physically aggressive behaviours directly, it may be that this occurs as a result of inhibition, shift and emotional control skills, more so than via working memory or planning/organizational skills. Specifically, children with these inhibition, shift and emotional control skills would likely present as less impulsive, more adaptable, more in control of their behaviour and thus more capable of approaching social standards of conduct when faced with situations in which physical aggression may serve as a viable option for meeting one's material or emotional needs. Contrarily, it is more difficult to understand how working memory and planning and organizing skills could impact physically aggressive behaviour as directly.

Summary of Study 2

In all, executive function skills, attachment, and to some extent authoritarian parenting (possibly in a more indirect way) all emerged as related to physical aggression. The current research most strongly supports the use of executive function skills (in particular inhibition, shift and emotional control) in the prediction of physical aggression among children aged 22 - 55 months of age. Moreover, among the executive function scales included in regression analyses, both emotional control and inhibition were found to be independently predictive and therefore most highly relevant to the prediction of physical aggression. The current sample was limited to a small number of participants, and therefore the power to detect significant findings was limited. Accordingly, future research should assess the relative predictive strength of executive skills and

attachment (and possibly parenting styles as well) among a larger sample, in order to determine whether social-interactional variables like attachment and parenting styles truly do not add to the prediction of physical aggression over and above the variance accounted for by executive function, a cognitive factor.

Integrating Across Studies: Exploring the Sensitive Period Hypothesis

An additional goal of this research project was to consider whether the results from Study 1 and 2 support Tremblay's (2000; 2001) suggestion of a sensitive period existing from approximately 24-36 months of age, wherein during this time children are better equipped to learn to inhibit physically aggressive behaviour. To this end, change over time correlational findings from Study 1 were compared to those of Study 2. Study 1 involved older children (mean age = 42 months, *SD* = 7.88), most of whom were *past* the proposed sensitive period for learning to inhibit physical aggression, while Study 2 involved a younger sample. Although Study 2 involved some children who were already beyond the proposed sensitive period for learning to inhibit physical aggression, the mean age for children in Study 2 was lower than Study 1, and children in Study 2 were closer to the proposed sensitive period for learning to inhibit physical aggression (mean age = 34 months, *SD* = 8.46). Given that the widely accepted definition of a "sensitive period" does not center on there being a rigid boundary for the period of development that defines the beginning or end of a sensitive period (Bruer, 2001; Knowland & Thomas, 2009), a comparison of these two studies was meaningful, as the mean age in Study 2 was regarded to be in closer proximity to the proposed sensitive period than the mean age of Study 1. As was stated in the general Introduction, sensitive periods are considered to be temporally longer and less well-defined than critical periods, and can refer to developmental

periods during which specific experiences (or lack thereof) seem to have particularly potent effects (Bruer, 2001).

Although this research was never intended to definitively assess whether or not a sensitive period exists for the development and inhibition of physically aggressive behaviour, it was hypothesized that gains in executive function and in vocabulary skills would be more strongly related to decreases in physical aggression in Study 2 (when participants were closer to the proposed sensitive period) than in Study 1, when children were developmentally further away from the proposed sensitive period. Accordingly, it was hypothesized that correlations between changes in physical aggression and changes in executive function/vocabulary over time would be higher in Study 2.

Integrative Results

Fisher's r to z transformations were conducted on the "change over time" correlation findings for Study 1 and 2, in order to assess whether the magnitudes of these correlations differed significantly (Howell, 2002). Fisher's formula compares two independent correlation coefficients and yields a Z-score, which when compared to a critical Z-value, tests the significance of the difference between the magnitudes of the two coefficients.

Although Study 2 involved several measures of physical aggression, the second time point of Study 1 only included parent ratings of the CBS measure thus limiting the calculation of difference scores in Study 1 to parent reports alone. Consequently, comparisons between longitudinal differences score correlations across the two studies could only be made between associations involving parental ratings on the CBS. Accordingly, a total of seven Fisher's r to z transformations were conducted in order to test the hypothesis that the magnitudes of the change over time correlations would be larger in Study 2 than in Study 1. Not all of the difference score

correlations were found to be significant in Study 1 or Study 2. However, given power limitations in both studies, and existing hypotheses, comparisons were still made. Two-tailed Fisher's r to z tests were employed. Table 22 presents the difference score correlations from both Study 1 and 2, as well as the results of the Fisher's r to z transformations.

The results of the seven Fisher's r to z tests revealed that the magnitudes of most of the cross-time difference score correlations did not vary between the two studies. The connection between changes in parent-reported physical aggression and changes in parent-reported Shift and Expressive language were significantly stronger in Study 2 with a younger sample as compared to Study 1; this is consistent with the possible existence of a sensitive period. The fact that none of the correlations in Study 1 are significantly larger than those in Study 2 is also of interest as well. As can be seen in Table 22, difference score correlations across Study 1 and 2 for matched pairs are either similar in magnitude or differ in the predicted direction (with Study 2 correlations being greater in magnitude). The fact that these results were obtained with such small age differences between the two samples also highlights the significance of these results, and suggests that the sensitive period hypothesis should be assessed further by future research. The current research was novel in its attempt to address the existence of a sensitive period for the development and inhibition of physical aggression. If the current results were to be replicated, support for the existence of this sensitive period would be strengthened. Ideally, future studies would also go beyond the current exploratory research design, however, in order to assess the sensitive period hypothesis more rigorously, by comparing larger samples of children, with more restricted and non-overlapping age ranges (children within the proposed sensitive period compared to children outside of the proposed sensitive period).

Table 22

Difference Score Correlations for Study 1 and 2 and Comparisons using Fisher's r to z Transformations

Measure	Study 1 Parent CBS Aggression Difference Score	Study 2 Parent CBS Aggression Difference Score	Fisher's Z
Diff. Parent Inhibit	**0.22***	0.24	0.27
Diff. Parent Shift	0.02	**0.60****	**2.18***
Diff. Parent EC	**0.20***	**0.52****	1.21
Diff. Parent WM	**0.25***	0.19	-0.20
Diff. Parent PO	0.08	0.15	0.24
Diff. Receptive	0.13	0.19	0.83
Diff. Expressive	0.05	0.21	**2.19***
N	69	21	

Note: EC = emotion control; WM= working memory; PO = planning/organization; all significant correlations are in bold and are marked by asterisks; df for correlations = 19-67; * = $p < .05$, ** = $p < .01$.

General Discussion

The primary research question in the present program of study was whether domains of cognitive and social interactional functioning would be related to and predictive of physical aggression and changes in physical aggression at various ages during the preschool years. Embedded within this broader question was interest in which variables (within cognitive and social interactional domains) would emerge as being the strongest predictors (i.e., relative to each other) as well as what sort of cumulative effects would be seen in the prediction of physical aggression when variables from both domains were considered together. Study 1 afforded consideration of "relative" and "cumulative" associations for sets of cognitive variables identified in the literature to be of critical importance: executive function and language. Study 2 similarly included these cognitive variables (building in the chance for a replication) but also incorporated social interactional variables (attachment and parenting style), which allowed for a more comprehensive look at the primary research question. This also fit more consistently with the developmental psychopathology framework which purports that biological, psychological and social factors likely interact in the expression of both typical and atypical development (Cicchetti, 2006). Of secondary interest was the exploration of a possible sensitive period (24 to 36 months) proposed by Tremblay (2000; 2001) wherein children learn to inhibit aggressive behaviours. Given that Study 1 and Study 2 included samples of preschoolers from differing age groups (with some overlap), it was possible to compare similar analyses across studies (i.e., related to changes in physical aggression) to see whether the present findings would fit with a sensitive period hypothesis. Both of the research questions were addressed, although opportunities remain for future research to expand on the current results (discussed below).

The findings from Study 1 and 2 lend some insight regarding the strength and consistency of both cognitive and social-interactional predictors of physical aggression. This research contributed to the theoretical understanding of connections between these variables. Specifically, in line with previous research (Dodge et al., 2006; Hughes, Dunn & White, 1998; Hughes & Ensor, 2006; Moffitt, 1993; Seguin & Zelazo, 2005) in both of the current studies, aspects of executive function (inhibition and emotional control especially) appeared to be particularly important in the prediction of physical aggression. The predictive value of executive function (inhibition by itself in Study 1 and inhibition, shift and emotional control combined in Study 2) often did not entirely diminish in the presence of other predictor variables (i.e., vocabulary and attachment). Moreover, across the two studies (and therefore spanning ages 24-74 months), reported declines in executive dysfunction (to some extent in all domains except planning/organization) were largely tied to decreases in physical aggression scores as well.

Measurement of Executive Function

The use of the BRIEF-P, and the assessment of the relative importance of distinct areas of executive function in the prediction of physical aggression is novel. Accordingly, this was of particular interest in the current research. This gap in the literature may reflect a scepticism regarding the measurability of multiple domains of executive function during the preschool years (Epsy et al., 2001). It is important to note that the BRIEF-P is a measure of executive dysfunction (not function). It differs both theoretically and statistically from other performance-based executive tasks (e.g., the Conners Continuous Performance Test-II and the Tests of Variables of Attention) used to measure executive function (Bodnar et al., 2007; McAuley et al., 2010). The BRIEF-P assesses the behavioural indices of executive function, and in this way, has been suggested to be more ecologically valid (Burgess, Alderman, Evans, Emslie, & Wilson,

1998; Gioia et al., 2002, Gioia, Isquith, Guy & Kentworthy, 2000). The BRIEF-P measures behavioural indices of executive function, while performance-based tasks of executive function assess the degree to which children can apply executive abilities in a controlled environment. This may limit the extent to which findings from Study 1 and Study 2 can be generalized regarding the relation between physical aggression and executive skills measured by performance-based means. The behaviours assessed by the BRIEF-P (behavioural indices of executive function in the natural environment) may not in fact be strongly related to the abilities assessed by laboratory tasks which also purport to measure executive function. Thus, a preschooler may be seen to be functioning relatively well with respect to the executive skill of inhibition using a lab-based task such as the Conners Continuous Performance Test-II, but this does not necessarily mean that the same child would similarly display inhibition behaviours (as measured by the BRIEF-P) within the context of the peer group. Conversely, a child who may be rated by a teacher or parent on the BRIEF-P as displaying few of the problematic behaviours which are typically associated with inhibition deficits, without having mastered the underlying skill set and therefore performing more poorly on a lab-based task measuring inhibition; a particularly shy child with relatively little cognitive inhibition skills may appear to show few inhibition problems in a large group of peers (e.g., at daycare) for example, but this may be more related to a tendency not to engage with peers rather than an underlying executive/inhibitory deficit.

In this research, the BRIEF-P measure was selected in favour of performance-based measures of executive function because of its ecological validity, sensitivity to dysfunction, domain specificity, and in order to avoid reliance on verbal proficiency (as the BRIEF-P does not require children to communicate with the examiner; Davidson et al., 2006; Gioia et al., 2002;

Kirkham & Diamond, 2003). Given this choice of measurement the findings are limited to conclusions drawn about executive dysfunction in real-world settings. It would be of interest for future research to employ laboratory-based measures of executive function as well, in order to assess whether similar findings emerge.

Physical Aggression and Cognitive Variables

The current research supports the use of the BRIEF-P, at least in the prediction of physical aggression. While several areas of executive function emerged as being related to physical aggression, there were differential relations with physical aggression across the executive domains. Inhibition skills were found to appear consistently relevant to physical aggression across numerous analyses within the two studies. Although this suggests the possibility that inhibition skills are particularly relevant to the manifestation of physical aggression during the preschool years, this finding may also relate to the possibility that inhibition skills develop earlier than other components of executive function (Raaijmakers et al., 2008) and/or the possibility that inhibition skills facilitate the development of organization skills, planning, problem solving and other executive skills (Bodnar et al., 2007; Zelazo et al., 1997).

In contrast to the consistent link found between aspects of executive function and physical aggression, in both studies, associations between physical aggression scores and vocabulary skills were weak and inconsistent, particularly when the CBS was employed as the measure of physical aggression. Previous literature does not suggest a particularly strong relationship between vocabulary and physical aggression (e.g., Dionne et al., 2003). In fact, the magnitudes of many of the non-significant relationships were somewhat in line with those found in previous literature (e.g., Dionne et al., 2003), pointing to the current findings being limited by small sample sizes and a lack of power. While language may be a predictor of children's

physical aggression, and expressive language may be more relevant to its prediction than receptive vocabulary (according to Study 1 results), Study 1 suggested that the predictive relevance of both of these vocabulary domains is largely washed away when executive function skills are known.

Theory and research (e.g., Hughes & Graham, 2002; Liebermann, 2010; Muller, et al., 2009; Sarsour, et al., 2011; Vygotsky, 1962) suggest that verbal skills promote cognitive and executive functioning. While language ability may indeed have some influence on the development of executive skills, this was not the focus of the current research. However, results of this research suggest that executive skills predict physically aggressive behaviour even after controlling for expressive and receptive vocabulary skills. This would suggest that language ability and executive function can be distinguished as conceptually different constructs.

Expressive vocabulary, receptive vocabulary, and five subscales of executive function (inhibition, shift, emotional control, working memory and planning/organization skills), were analyzed separately in the present research, rather than utilizing an overarching, potentially "higher-order" factor, such as general intelligence (also known as *g*). For over one hundred years, researchers have been aware of the fact that cognitive abilities tend to correlate with one another (e.g., Spearman, 1904). There remains a debate in the literature, however, regarding the existence and utility of a general intelligence construct. Matzke, Dolan, and Molenaar (2010) have argued that evidence supporting the general intelligence factor is largely based on findings that show extremely high, almost identical correlations between *g* and lower-order factors (e.g., working memory, language ability, etc.). These findings seem to suggest redundancy in the measurement of multiple lower-order cognitive domains. However, Matzke and colleagues (2010) critique the method by which research has obtained support for there being links between

cognitive domains. These researchers note that much of the research supporting the existence of *g* has been conducted with limited power to detect significant differences between *g* and lower-order cognitive abilities. This is one of the arguments against the use of *g* as a clinical or predictive measure. Accordingly, Matzke and colleagues (2010) advocate the use of domain-specificity in research assessing cognitive abilities in order to achieve a greater level of parsimony. What exactly general intelligence measures assess or do not assess is difficult to identify. While general intelligence may or may not exist, may or may not be measureable, and may or may not encapsulate all of the cognitive abilities included in the current research, *g* is described as an "ill-defined" concept (Matzke et al., 2010, p. 342). Finding correlations between *g* and physical aggression in the current research would not likely have yielded a great deal of practical utility, as it would be difficult to interpret such a result. The use of domain-specific cognitive abilities in the current research served to increase utility, and made it possible to assess whether specific cognitive abilities would be differentially related to the use of physical aggression.

Overlap did exist between the cognitive variables of interest in this research, calling into question the ease with which these abilities can be distinguished at this age. One particular difficulty in this regard was the overlap between the different subscales of executive function. The high degree of intercorrelation for BRIEF-P subscales points back to the underlying debate over whether executive function in the preschool years is better characterized as a unitary construct, not yet dissociable (Wiebe et al., 2011). Although the resolution of this debate is important for the field as a whole, it was beyond the scope of the present research design. A more practical constraint was that the overlap between the different scales of executive function did not allow for all of the subscales to be included in regression analyses together. This

restricted the extent to which conclusions could be made about the cumulative predictability of domains of executive function in the current research. Taking all the variables as a set, however, it is notable that findings identified some of the predictor variables as more relevant to the prediction of physical aggression than others. This ultimately supports the utilization of domain-specific cognitive measures and subscale-level executive function measures as predictive tools.

Overall, the current findings suggest that one potentially common developmental pathway leading to high levels of physical aggression may involve an inhibitory deficit. Physical aggression tends to be highest during the second year of life (Tremblay, 2000; 2001), and physical aggression at this stage of development is generally an accepted and functional means of communication and resource-attainment. However, some children with poorer inhibition skills may continue to rely on a previously functional script which allows for the use of physical aggression beyond the point when this behaviour is socially acceptable. This may relate to aspects of cognitive inhibition including not only self-control but also cognitive flexibility (Welsh, 2002; Zelazo et al., 1997). While connections appear to exist between language skills and physically aggressive behaviour, inhibition skills may be more predictive of physical aggression because they allow a child who has language skills to effectively learn to apply the new social script of "using their words" rather than aggressing physically in order to meet their wants and needs following the second year of life. It is important to remember, however, that this is only one possible explanation for physically aggressive tendencies. The developmental psychopathology model (and the concept of equifinality in particular) would suggest that no one pathway can account for all of the numerous ways that children's development can diverge from what is viewed to be the normative course (i.e., learning to inhibit physical aggression during the

third year of life; Cicchetti, 2006; Cicchetti & Rogosch, 1996; Gollan, et al., 2005; Reebye, 2005; Tremblay, 2000; Tremblay, 2001).

Inclusion of Social Interactional Variables in the Prediction of Physical Aggression

Moving beyond a sole focus on cognitive variables in isolation, Study 2 incorporated both cognitive and social-interactional predictors of physical aggression. Authoritarian parenting was also found to predict physical aggression, and attachment was implicated as a strong and uniquely important predictor. However, results from the current program of research appear to be most consistent with Moffitt's (1993) theory, and Baron and Richardson's (1994) third category (cognitive emotional processes) of emphases. Moffitt (1993) proposed that congenital neuropsychological deficits negatively affect a child's temperament, executive function and language abilities. These cognitive factors were subsequently believed to contribute to the development of aggressive behavioural tendencies (Brennan et al., 2003). Among these cognitive variables, the current research points most strongly to the possible influence of certain executive function skills. In Study 2 (which took place largely during the proposed sensitive period for learning to inhibit physical aggression) when the executive domains of inhibition, shifting attention and emotional control were combined with social-interactional variables (attachment and authoritarian parenting) on the same step of several regression equations, only inhibition and emotional control emerged as uniquely predictive of physical aggression. This suggests that cognitive and emotional processes may play an especially prominent role in the development and inhibition of physically aggressive behaviour among many children, at least at this age (mean age of Study 2 = 34 months at Time 1). In line with the sensitive period hypothesis, however, this may be an ideal time for interventions aimed at targeting physical aggression.

Implications

As specific executive deficits appear to be one common predisposing factor associated with the development of physical aggression during the preschool years, interventions at this age which improve executive skills such as the capacity to inhibit the cognitive activation of previously adhered-to behavioural scripts and controlling emotions may prove to be effective at decreasing physical aggression. This may include the direct instruction of cognitive strategies, including teaching a child to "stop, look, and listen" before they act (Goldstein & Naglieri, 2008, p. 869). These strategies can then be reinforced (e.g., through praise, tangible rewards or a token economy system) when the child employs them.

Research has shown promise that neurocognitive skills such as inhibitory control can be improved with experience or practice with tasks that require these skills, even in children as young as 3-years of age (Dowsett & Livesy, 2000). Dowsett and Livesy (2000) tested the inhibitory control skills of 160 3-5-year-old children using the go/no-go discrimination learning task. In this task children were asked to press a button as quickly as they could when a red light was lit, but not to press the button when a blue light appeared. Dowsett and Livesy (2000) found that among this sample, 49 children showed high levels of inhibitory control problems (pressing the blue light at least 80% of the time when it appeared). These 49 children were randomly assigned to either receive three additional 15-20 minute opportunities to practice doing the go/no-go discrimination learning task (practice group), to receive three 15-20 minute training sessions which involved practice until the child was able to master three other tests of inhibitory control that were similar to the go/no-go discrimination learning task (training group), or to a control group. Children in the practice and training groups were rewarded with a sticker for "performing so well" at the end of each practice/training session. Both the practice and training

groups were found to show an improvement in inhibitory control when re-tested using the go/no-go discrimination learning task. Moreover, the training group showed significantly greater improvement than the practice group (Dowsett & Livesy, 2000). These authors did not assess whether or to what extent the benefits of practice and training were retained over an extended period of time, however.

It would also be of interest for future research to assess the potential real-world benefits of such training. Given the strong link to inhibition in the current research, it is possible that the type of training experienced by the children in Dowsett and Livesy's (2000) training group may lead to decreases in physical aggression as well. A replication of Dowsett and Livesy's research design could be employed, along with the addition of measures to assess children's physical aggression before and after the opportunity to train for inhibitory control tasks. Perhaps with a large enough sample, multiple practice and training groups could be involved, varying the duration of the training so as to assess whether this impacts the extent to which physical aggression may be impacted by experience with inhibitory control tasks.

Behaviour management strategies can also be employed in an effort to increase a child's "capacity to self-inhibit before acting" (Goldstein & Naglieri, 2008, p. 869) and in turn decrease their use of physically aggressive behaviour. One commonly used behaviour management technique is contingent attention from caregivers (e.g., parents and teachers), whereby a child is ignored when he or she behaves inappropriately (such as when they aggress; Goldstein & Naglieri, 2008). Sometimes aggression and other transgressions cannot be ignored, however. In these instances time-outs may be an effective way to withhold natural reinforcement such as attention (Goldstein & Naglieri, 2008; Hembree-Kigin & McNeil, 1995).

Finally, Riggs, Greenberg, Kusche and Pentz (2006) assessed the efficacy of an elementary-school-based program which seeks to "reduce aggression and behaviour problems by promoting the development of social-emotional competence" (p. 93). The Promoting Alternative Thinking Strategies (PATHS) program focuses on helping children learn to gain better control of their emotions by enhancing the "higher order processing skills" (p. 93) typically associated with the prefrontal cortex. Children are given direct instructions on strategies designed to help with self-control and inhibitory control and allowed opportunity to practice these strategies. A poster of a traffic light is employed as a tool to explain the importance of stopping to calm down (e.g., take a deep breath) and slowing down and think and develop a plan of action before a person acts. Children also participate in activities which require them to label various emotions. These interventions are thought to help improve neural integration of prefrontal cortex skills (i.e., executive function skills like emotional control and inhibition) and limbic activity (which largely governs the emotions thought to contribute to impulsivity and aggression).

Riggs et al. (2006) randomly assigned three hundred and eighteen second and third grade boys and girls to either participate in the PATHS program (153 children) or to be in a control group (165 children). The PATHS lessons were taught by teachers (who had themselves participated in a 3-day training workshop) three times per week for approximately 20-30 minutes each session over a period of 6 months. Riggs and colleagues found that those who were enrolled in the PATHS program were subsequently found to show significantly better inhibitory control (as measured by the Stroop Test) and verbal fluency (as measured by The Verbal Fluency Subtest of the McCarthy Scales of Children Abilities) as well as fewer internalizing and externalizing behaviour problems (according to teacher reports on the Child Behavioral Checklist) upon one-year follow-up (Riggs et al., 2006).

The results of Riggs and colleagues' (2006) study are in line with the current research findings, suggesting a link between executive skills (e.g., inhibition and emotional control) and aggression. Although the PATHS program is designed for use in schools, some of the intervention strategies involved in the PATHS program may be appropriate with a preschool population of children as well. In fact, given the possibility that a sensitive period may exist sometime during the preschool years, this type of intervention may actually be even more advantageous if applied at a younger age. The fact that the program did have success during the school years does not necessary contradict the sensitive period hypothesis, as changes can occur outside of a sensitive period, however, development is thought to be more easily (or to a greater degree) altered during or in close proximity to a sensitive period (Bruer, 2001; Knowland & Thomas, 2009).

The effectiveness of another program designed by Diamond, Barnett, Thomas, and Munro (2007) has been assessed with a preschool population. In a study of 147 preschoolers from 21 classrooms in a low-income, urban school district (i.e., children who are at-risk for having poor executive skills), classes were randomly assigned to one of two conditions. Both conditions had educational curricula, however only one was directly designed to improve executive function: The Tools of the Mind Curriculum (Diamond, et al., 2007). In this condition, teachers reportedly spent approximately 80% of every day encouraging executive function skills. This program is based on Vygotsky's theory that language mediates the development of executive function. This curriculum involved "40 EF-promoting activities" (Diamond, et al., 2007, p. 1387) including teaching children to use dramatic play and say aloud what they should be doing during an activity. After 1-2 years (most children were in the study for 2 years, but a minority joined the study halfway through and another minority left the control condition after a

year), Diamond found that children in the Tools of the Mind Curriculum condition significantly outperformed the other children on several tasks of executive function involving inhibition skills, working memory and cognitive flexibility (also known as shifting). Diamond and colleagues (2007) suggested that this early intervention program was successful in improving the executive function skills of children at-risk for poor executive development.

Taken together, the results of Diamond and colleagues' (2007), Riggs and colleagues' (2006), Dowsett and Livesy's (2000) and others' (e.g., Ford, McDougall, & Evans, 2009; Tsai, 2009) research are promising, in that with instruction and practice, children's executive skills can seemingly be improved. This may, in turn, have a neutralizing impact upon physically aggressive behaviour problems.

In Study 2, while attachment was largely found to have little predictive relevance in the presence of executive function (although sample size and power was limited), children who showed increases in the reported quality of their attachment to their caregivers over time also showed corresponding decreases in their reported level of physical aggression. Accordingly, attachment relations may also be an area of development worthy of intervention for children who show high levels of physical aggression during the proposed sensitive period. Parent-Child Interaction Therapy is an empirically supported intervention designed to improve parent-child relations (including attachment) while also targeting problem behaviours such as physical aggression (Hembree-Kigin & McNeil, 1995).

Returning to the developmental psychopathology framework, it is important to remember that not all highly physically aggressive children present with underlying cognitive deficits, or attachment problems. In designing interventions, it is important to attend to the needs of the individual child, by identifying and targeting the predisposing and precipitating factors relevant

to their presenting problem. The current research was limited to the identification of some common factors which appear to often be associated with physical aggression among a general population.

Strengths and Limitations

One limitation of the current research was the decision to rely on subjective ratings of physical aggression, executive function, attachment, and parenting style. As such, all of these measures assessed rater perceptions, rather than objective behaviours. Whenever possible, however, multiple informants were involved. According to Digiunta and colleagues (2010), "to better understand aggression, researchers need to investigate nonaggregated forms of aggressive behavior and use multiple-informant strategies" (p. 879). The current research involved a high degree of specificity with regard to type of aggression (i.e., physical aggression rather than aggression in general or externalizing behaviour), and incorporated some new items in Study 2 in an attempt to further increase item specificity. An effort was also made in the current research to employ both parent and teacher ratings whenever possible. This was not done for ratings of children's attachment to their parents nor for parenting style, as it is not common practice to ask teachers to rate their opinions of parents' relationship with their child or parenting practices and would be of questionable validity.

The use of multiple raters also allowed for a comparison of the psychometric properties yielded by the parents versus teachers. Given the findings that teacher ratings of physical aggression tended to yield higher reliability values than parent ratings, and the greater degree of overlap between teacher-rated physical aggression measures in Study 2, it seems that teachers provide a more consistent and possibly more objective measure of children's physical aggression. The use of multiple raters did necessitate a high number of analyses, however,

increasing the possibility of Type 1 error. Likewise, at times ambiguity emerged in the interpretation of findings when parent and teacher results were not consistent with one another. This underscores the strengths and limitations of any study employing multiple informants. However, in the current study, it may have been particularly important to employ both parent and teacher ratings in order to gain a comprehensive overview of physically aggressive behaviour, as this allowed for an assessment of children's behaviour in multiple environmental settings; some children do behave differently at home versus in a daycare setting or with different caregivers.

One of the major limitations of the current research was the reliability of certain measures (especially parent-rated CBS and times per week measures of physical aggression in Study 2: Cronbach Alpha Values = 0.58-0.63). It should also be noted that the CBS measure employed in Study 2 included one different item than in Study1, which could have had a deleterious impact on the measure's reliability for parents. However, at least one study using the same CBS items (as in Study 2; Cote and colleagues, 2007) yielded higher (0.66) reliability values than what were obtained in the present investigation. As mentioned above, findings from Study 2 suggest that teachers seem to provide more consistent ratings of physical aggression. An alternative interpretation to teachers being more accurate raters of physical aggression than parents is that perhaps the CBS item format does not provide a sufficiently high level of specificity. Presumably parents see their children more often than do daycare teachers, therefore it is possible that they are better at drawing a distinction between different types of aggression their child displays. Perhaps the reason parents' reports are less reliable is that the items themselves are not adequately related. A child who "reacts with anger and fighting" at 2 years of age for example, may not also be inclined toward kicking, biting or hitting, at least at home. Given that previous research (e.g., Cote et al. 2007) has yielded more acceptable reliabilities for the CBS

measure, however, it may just be that this was the case in current sample, or that parents in the current sample did not attend carefully to the physical aggression items. This latter possibility may have resulted with the addition of nine items over and above the usual three CBS items in Study 2. In either case, this impacts the level of confidence with which findings (especially in Study 2, using parent ratings of physical aggression) can be interpreted; indeed some degree of caution should be employed. If the measure in itself does not in fact assess physical aggression to a sufficiently high degree of specificity (i.e., the behaviours the items aim to assess are not actually in and of themselves related to one another) then the construct of "physical aggression" was not measured in a reliable way. This suggests measurement error. More items assessing each aspect of physical aggression would be required in this case. Accordingly, if parents did not attend carefully to each of the items, the measure is neither a reliable, nor valid assessment of children's behaviour (as validity does not exist in the absence of reliability; Berk & Roberts, 2009). A potential end result of having physical aggression measures with low internal consistencies is that effect size magnitudes may be underestimates of the actual associations that may exist between physical aggression and the predictor variables included in the current research (Pedhazur, 1982).

The use of small sample sizes, particularly during the second time points of both studies, was another major limitation of this research. This limited the power to detect significant findings. It also precluded certain analyses, such as Time 2 regressions in Study 2, the prediction of Time 2 physical aggression as a function of Time 1 variables in Study 2 (as was done in Study 1), and in both studies regression analyses could only accommodate a restricted number of predictor variables.

The decision to eliminate four of the executive function subscales in Study 1 and two subscales in Study 2 from the primary regression analyses was made in order to minimize multicollinearity. However, this also limited the capacity to compare different theoretical approaches (i.e., cognitive versus social-interactive models). It likewise precludes results from pertaining to "executive function" in general. Rather, Study 1 focused primarily on the relevance of inhibition skills in the prediction of physical aggression, while Study 2 incorporated inhibition, shift and emotional control skills. Given that the current research was limited to parent and teacher perceptions of physical aggression and executive function, it would be of interest for future research to assess whether similar relations between physical aggression various domains of executive function would be found using observable or task-based measures.

Finally, in some cases in order to measure the same constructs, different measures were employed in each of the two studies. Specifically, one item was replaced in the CBS scale in Study 2 and vocabulary was measured using a different instrument in Study 2 (as compared to Study 1). These decisions were made in order to ensure that all measures were developmentally appropriate. The way older preschoolers aggress is not necessarily the same as the way that younger preschoolers manifest the same construct of physical aggression (Cote et al., 2007), and vocabulary tends to develop rapidly during the preschool years (Courage & Howe, 2002; Ganger & Brent, 2004), necessitating a measure that is sensitive to developmental expectations and norms. The use of different measures across the two studies does call into question the degree to which these two studies can be compared, however. While this may also have potentially contributed to inconsistencies in findings between the two studies (e.g., vocabulary appearing to be more strongly related to CBS physical aggression scores in Study 1 as compared to Study 2),

this limitation most notably pertains to analyses designed to address the potential sensitive period for learning to inhibit physical aggression.

Sensitive Period Hypothesis: Findings, Limitations and Directions for Future Research

Although the current research attempted to explore the sensitive period hypothesis, there were several limitations in how this question was addressed in the current research. At the root of the sensitive period exploration was the capacity to compare two samples of children at different age points that were either closer to (i.e., Study 2) or further from (i.e., Study 1) the hypothesized sensitive period of 24 to 36 months. In addition to having different age groups in Study 1 and 2, however, samples were also collected from different geographical regions and employed different (age-appropriate) measures of vocabulary as well as one differing (age-appropriate) item to assess physical aggression. Also, a wide age range was included in each of the two studies for practical purposes, making it difficult to clearly identify one sample as being within the sensitive period and the other outside the sensitive period. These factors could have had an impact on longitudinal findings. Therefore, conclusions about the existence of a sensitive period for learning to inhibit physical aggression have been interpreted with a high degree of caution. Findings from the current research did however point to the possibility of there being a sensitive period for learning to inhibit physical aggression, which could range from 24-36 months as Tremblay (2000, 2001) has suggested. Again, however, the notion of this being a sensitive period rather than a critical period suggests a loose boundary for the commencement and cessation of this potentially important developmental period.

In order to further assess whether or not a sensitive period exists, future research could replicate the current research design in order to test whether or not gains in executive or verbal domains are consistently more strongly tied to decreases in physical aggression among children

who are proximally closer in age to the proposed sensitive period. Following several repeated studies of this nature, a meta-analysis could then potentially be performed to assess the significance of patterns across studies. Ideally, however, more scientifically rigorous research would also be conducted to address the sensitive period hypothesis. Specifically, a study aimed solely at testing the sensitive period hypothesis would employ two very large samples of children; one that begins when children are all as close to 24 months of age as possible, and another comparable sample of children who are at least 36 months of age when data collection begins. The level of attrition found in the current research would suggest that each of the samples would ideally include at least 400 children at the first phase of data collection for both studies. Based on the experiences of the present study, even with significant attrition, one might expect at least 100 children with completed data at both time points. This sample size would likely still limit the number of predictors that could be included in regression analyses, however (Tabachnick & Fidell, 2007). The larger the sample, the more analytic freedom the researcher would have, however it would be challenging to attain a sample larger than 400 with a sufficiently restricted age range (at a single site) to adequately compare children within and outside the proposed sensitive period for learning to inhibit physically aggressive behaviour tendencies.

At the present time, until further evidence is gathered that either supports or refutes the sensitive period hypothesis, theory alone (i.e., Tremblay 2000; 2001) does suggest that interventions aimed at decreasing physical aggression may be most effective when children are 24-36 months of age. The current research suggests that it may be beneficial for these interventions to target a number of variables. This fits with the developmental psychopathology model, which suggests that different children may take different developmental paths leading to

varying degrees of physically aggressive behaviour. Among the variables associated with physical aggression during the preschool years, the current research points to executive function skills such as the ability to inhibit maladaptive cognitive scripts and the control of emotional responses as being highly relevant.

References

Achenbach, T. M., & Rescorla, L. A. (2000). *Manual for ASEBA Preschool Forms & Profiles*. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families.

Ainsworth, M.D.S, Blehar, M.C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation.* Hillsdale, NJ: Erlbaum.

Alvarez, J.A., & Emory, E. (2006). Executive function and the frontal lobes: A meta-analytic review. *Neuropsychology Review, 16,* 17-42.

Arsenio, W. (2004a). Trajectories of physical aggression from toddlerhood to middle childhood: Predictors, correlates and outcomes. *Monographs of the Society for Research in Child Development.* NICHD Early Child Care Research Network.

Arsenio, W. (2004b). The stability of young children's physical aggression: Relations with child care, gender, and aggression subtypes. *Monographs of the Society for Research in Child Development, 69,* 4, 130-143.

August, D., Carlo, M., Dressler, C., & Snow, C. (2005). The critical role of vocabulary development for English language learners. *Learning Disabilities Research & Practice, 20*, 50-57.

Baillargeon, R.H, Normand, C.L., Seguin, J.R., Zoccolillo, M.J., Japel, C., Perusse, D., Wu, H.X., Boivin, M., & Tremblay, R.E. (2007). The evolution of problem and social competence behaviors during toddlerhood: A prospective population-based cohort survey. *Infant Mental Health Journal, 28*, 12-38.

Banaschewski, T. (2010). Editorial: Preschool behaviour problems – over-pathologised or under-identified? A developmental psychopathology perspective is needed. *Journal of Child Psychology and Psychiatry, 51,* 1-2.

Baron, R., Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Baron, & Richardson, (1994). *Human aggression* (2nd ed.). New York, NY: Plenum Press.

Bartholomew, K. & Horowitz, L.M. (1991). Attachment styles among young adults: A test of a four–category model. *Journal of Social and Personality Psychology, 61,* 226-244.

Bartle, S.E., Anderson, S.A., Sabatelli, R.M. (1989). A model of parenting style, adolescent individuation and adolescent self-esteem: Preliminary findings. *Journal of Adolescent Research, 4,* 283-298.

Baumrind, D. (1967). Child care practices anteceding three patterns of preschool behaviour. *Genetic Psychology Monographs, 75,* 43-88.

Baumrind, D. (1968). Authoritarian vs. Authoritative parental control. *Adolescence, 3,* 255-272.

Baumrind, D. (1971). Current patterns of parental authority. *Developmental Psychology Monograph, 4,* 1-103.

Bayley, N. (2005). Bayley scales of infant development (3rd ed.) Oxford: Harcourt Assessment.

Berk, L.E., & Roberts, W.L. (2009). *Child development* (3rd ed.). Toronto, ON: Pearson.

Biemiller, A., & Slomin, N. (2001). Estimating root word vocabulary growth in normative and advantaged populations: Evidence for a common sequence of vocabulary acquisition. *Journal of Educational Psychology, 93,* 498-520.

Bierman, K.L. (2003). Programs and services proven to be effective in reducing aggression in young children: Comments on Webster-Stratton, Domitrovich and Greenberg, and Lochman. *Encyclopedia of Early Child Development,* 1-6.

Bjorklund, D.F. (2005). Children's thinking: Cognitive development and individual differences (4th ed.). Pacific Grove, CA: Brooks / Cole.

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology, 20,* 899-911.

Blair, C., & Razza, R.P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78,* 647-663.

Bodnar, L.E., Prahme, M.C., Cutting, L.E., Denckla, M.B., & Mahone, E.M. (2007). Construct validity of parent ratings of inhibitory control. *Child Neuropsychology, 13,* 345-362.

Bonica, C. Arnold, D.H., Fisher, P.H., & Zeljo, A. (2003). Relational aggression, relational victimization, and language development in preschoolers. *Social Development, 12,* 4, 551-562.

Bonli, R. (2005). An investigation into the early development of executive functions and theory of mind in Autism and in typical development. *Dissertation Abstracts International, 66* (09), 181B. (UMI No. AAINR06250).

Bowlby, J. (1969). *Attachment and loss: Vol. I. Attachment.* New York: Basic Books.

Borge, A.I.H., Rutter, M., Cote, S., & Tremblay, R.E. (2003). Early childcare and physical aggression: Differentiating social selection and social causation. *Journal of Psychology and Psychiatry, 45,* 367-376.

Boris, N.W. (2003). Attachment, aggression and holding: A cautionary tale. *Attachment & Human Development, 5*, 245-247.

Brame, B., Nagin, D. & Tremblay, R. (2001). Developmental trajectories of physical aggression from school entry to late adolescence. *Journal for Child Psychology and Psychiatry, 42,*503-512.

Brennan, P., Hall, J., Bor, W., Najman, J., & Williams, G. (2003). Integrating biological and social processes in relationship to early-onset persistent aggression in boys and girls. *Developmental Psychology, 39,* 309-323.

Bretherton, I., Ridgeway, D., & Cassidy, J. (1990). Assessing internal working models of the attachment relationship: An attachment story completion task for 3-year-olds. In M.T. Greenberg, D. Cicchetti, & E.M. Cummings (Eds.), *Attachment in the preschool years: Theory research, and intervention* (pp. 273-308). Chicago, IL: The University of Chicago Press.

Broidy, L., Nagin, D., Tremblay, R., Bates, J., Brame, B., Dodge, K., Fergusson, D., Horwood, J, Loeber, R., Laird, R., Lynam, D., Moffitt, T., Pettit, G., & Vitaro, F. (2003). Developmental trajectories of childhood disruptive behaviours and adolescent delinquency: A six site cross-national study. *Developmental Psychology, 39,* 222-245.

Bruer, J.T. (2001). A critical and sensitive period primer. In D.B. Bailey, J.T. Bruer, F.J. Symons, & J.W. Lichtman (Eds.), *Critical thinking about critical periods* (pp. 3-26). Toronto, ON: Paul H. Brookes Publishing Co.

Burgess, P.W., Alderman, N., Evans, J., Emslie, H., & Wilson, B.A. (1998). The ecological validity of tests of executive function. *Journal of the International Neuropsychological Society, 4,* 547-558.

Buri, J.R. (1989). Self-esteem and appraisals of parental behavior. *Journal of Adolescent Research, 4,* 33-49.

Buri, J.R. (1991). Parental Authority Questionnaire. *Journal of Personality Assessment, 57,* 110-119.

Byng-Hall, J. (2002). Relieving parentified children's burdens in families with insecure attachment patterns. *Family process, 41*, 375-388.

Campbell, S.B., Spieker, S., Vandergrift, N., Belsky, J., Burchinal, M., & The NICHD Research Network. (2010). Predictors and sequelae of trajectories of physical aggression in school-age boys and girls. *Development and Psychopathology, 22,* 133-150.

Carlson, S., Mandell, D., & Williams, L. (2004). Executive function and the theory of mind: Stability and prediction from ages 2 to 3. *Developmental Psychology, 40,* 1105-1122.

Cicchetti, D. (2006). Development and psychopathology. In D. Cicchetti & D.J. Cohen (Eds.), *Developmental psychopathology*. *Vol. 1: Theory and method* (pp. 1–23). New York, NY: Wiley.

Cicchetti, D., & Curtis, J. (2006). The developing brain and neural plasticity: Implications for normality, psychopathology, and resilience. In D. Cicchetti & D.J. Cohen (Eds.), *Developmental psychopathology*. *Vol. 2: Developmental Neuroscience* (pp. 1–64). New York, NY: Wiley.

Cicchetti, D., & Rogosch, F.A. (1996). Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology, 8,* 597-600.

Coolahan, K., McWayne, C., Fantuzzo, J., & Grim, S. (2002). Validation of a multidimensional assessment of parenting styles for low-income African-American families with preschool children. *Early Childhood Research Quarterly, 17,* 356-373.

Cooper, M.L., Albino, A.W., Orcutt, H.K., & Williams, N. (2004). Attachment styles and intrapersonal adjustment. In S.W. Rholes & J.A. Simpson (Eds.), *Adult attachment theory research and clinical implications* (pp. 439-467). New York, NY: Guilford Press.

Cote, S.M., Vaillancourt, T., Barker, E.D., Nagin, D.S. & Tremblay, R.E. (2007). The joint development of physical and indirect aggression: Predictors of continuity and change during childhood. *Development and Psychopathology, 19,* 37-55.

Cote, S.M., Vaillancourt, T., LeBlanc, J.C., Nagin, D.S. & Tremblay, R.E. (2006). The development of physical aggression from toddlerhood to pre-adolescence: A nation wide longitudinal study of Canadian children. *Journal of Abnormal Child Psychology, 34,* 71-85.

Courage, M., & Howe, M. (2002). From infant to child: The dynamics of cognitive change in the second year of life. *Psychological Bulletin, 128,* 250-277.

Crick, N.R. (2000). Engagement in gender normative versus nonnormative forms of aggression: Links to social-psychological adjustment. In W. Craig (Ed.), *Childhood Social Development* (pp.309-329). Maiden MA: Blackwell Publishers Ltd.

Crick, N.R., Ostrov, J.M., & Werner, N.E. (2006). A longitudinal study of relational aggression, physical aggression and children's social-psychological adjustment. *Journal of Abnormal* Child Psychology, 34, 131-142.

Cugmas, Z.(1998). The correlation between children's personal behavioural characteristics and indicators of children's attachment to their mother or father, respectively. *Early Child Development and Care, 143,* 65-78.

Cugmas, Z. (2004). Child's attachment to his/her mother, father and kindergarten teacher. *Early Child Development and Care, 177,* 349-368.

Cugmas, Z. (2007). Child's attachment to his/her mother, father and kindergarten teacher. *Early Child Development and Care, 4,* 349-368.

Danielsson, H., Henry, L., Ronnberg, J., & Nilsson, L. (2010). Executive functions in individuals with intellectual disability. *Research in Developmental Disabilities, 31,* 1299-1304.

Darling, N., & Steinberg, L. (1993). Parenting style as context: An integrative model. *Psychological Bulletin, 113,* 487-496.

Davidson, M.C., Amso, D., Anderson, L.C., & Diamond, A. (2006). Development of cognitive control and executive functions from 4 to 13 years: Evidence from manipulations of memory, inhibition, and task switching. *Neuropsychologia, 44,* 2037-2078.

Davies, P.T., & Cicchetti, D. (2004). Toward an integration of family systems and developmental psychopathology approaches. *Development and Psychopathology, 16,* 477-481.

DeMarte, J. (2008). The heterogeneity of antisocial behavior: Evidence for distinct dimensions of physical aggression, rule-breaking, and social aggression (PhD Dissertation). Available from Electronic Thesis and Dissertations Database. (UMI No. 3381108)

Deynoot-Shaub, M., & Riksen-Walraven, J. (2005). Peer interaction at child care centers at 15 and 23 months: Stability and links with children's socio-emotional development. *Infant Behaviour and Development, 29,* 276-288.

Diamantopoulou, S., Rydell, A., Thorell, L.B., & Bohlin, G. (2007). Impact of executive functioning and symptoms of Attention Deficit Hyperactivity Disorder on children's peer relations and school performance. *Developmental Neuropsychology, 32,* 521-542.

Diamond, A. (2000). Close interrelation of motor development and cognitive development and of the cerebellum and prefrontal cortex. *Child Development, 71,* 44-56.

Diamond, A. (2006) The Early Development of Executive Functions. In: Bialystok, E., Craik, F., *Lifespan Cognition: Mechanisms of change* (pp. 70-95). New York, NY: Oxford University Press.

Diamond, A. (2007). Consequences of variations in genes that affect dopamine in prefrontal Cortex. *Cerebral Cortex, 17,* i161-i170.

Diamond, A. (2009). When in competition against engrained habits, is conscious representation sufficient or is inhibition of the habit also needed? *Developmental Science, 12, 20*-22.

Diamond, A., Barnett, W.S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318,* 1387-1388.

Diamond, A., Briand, L., Fossella, J., & Gehlbach, L. (2004). Genetic and neurochemical modulation of prefrontal cognitive functions in children. *American Journal of Psychiatry, 161,* 125-132.

Diamond, A., Carlson, S.M., & Beck, D.M. (2005). Preschool children's performance in task switching on the dimensional change card sort task: Separating the dimensions aids the ability to switch. *Developmental Neuropsychology, 28,* 689-729.

Diamond, A., & Taylor, C. (1996). Development of an Aspect of Executive Control: Development of the Abilities to Remember What I Said and to "Do as I Say, Not as I Do". *Developmental Psychobiology, 29,* 315-334.

DiGiunta, L., Pastorelli, C., Eisenberg, N., Gerbino, M., Castellani, V., Bombi, A.S. (2010). Developmental trajectories of physical aggression: Prediction of overt and covert antisocial behaviors from self- and mothers' reports. *European Child Adolescent Psychiatry, 19,* 873-882.

Dionne, G., Tremblay, R., Boivin, M., Laplante, D., & Parusse, D. (2003). Physical aggression and expressive vocabulary in 19-month-old twins. *Developmental Psychology, 39,* 261-273.

Dishion, T., & Patterson, G. (1992). Age effects in parent training outcome. *Behaviour Therapy, 23,* 719-729.

Dishion, T. J., & Patterson, G. R. (2006). The development and ecology of antisocial behavior. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology. Vol. 3: Risk, disorder, and adaptation* (pp. 503–541). New York, NY: Wiley.

Dodge, K.A., Coie, J.D., & Lynam, D. (2006). Aggression and antisocial behaviour in youth. In W. Damon (Series Ed.), R.M. Lerner (Series Ed.), & N. Eisenberg (Vol. Ed.), *Handbook of Child Psychology: Vol. 3. Social, Emotional, and Personality Development,* (6th ed., pp. 719-788). New York: Wiley.

Dowsett, S.M. & Livesy, D.J. (2000). The development of inhibitory control in preschool children: Effects of "executive skills" training. *Developmental Psychobiology, 36,* 161-174.

Drabick, D.A.G., & Kendall, P.C. (2010). Developmental psychopathology and the diagnosis of mental health problems among youth. *Clinical Psychology Science and Practice, 17,* 272-280.

Duke, R.E., Bryson, S., Hammer, L.D., & Agras, W.S. (2004). The relationship between parental factors at infancy and parent-reported control over children's eating at age 7. *Appetite, 43,* 247-252.

Dunn, L.M., & Dunn, L.M. (1997). *Examiner's Manual for the Peabody Picture Vocabulary Test – Third Edition.* Circle Pines, MN: American Guidance Service.

Edwards, E.P., Das Eiden, R., & Leonard, K.E. (2006). Behavior problems in 18- to 36-month-old children of alcoholic fathers: Secure mother-infant attachment as a protective factor. *Development and Psychopathology, 18,* 395-407.

Eisenberg, N., Damon, W., & Lerner, R.M. (2006). *Handbook of child psychology: Volume 3 social, emotional, and personality development* (6th ed.). Hoboken, NJ: John Wiley & Sons.

Ellis, M.L., Weiss, B., & Lochman, J.E. (2009). Executive functions in children: Associations with aggressive behavior and appraisal processing. *Journal of Abnormal Child Psychology, 37,* 945-936.

Epsy, K.A., Kaufmann, P.M., Glisky, M.L., & McDiarmid, M. (2001). New procedures to assess executive functions in preschool children. *Clinical Neuropsychologist, 15,* 46-58.

Eron, L.D., & Huesmann, L.R. (1984). The control of aggressive behavior by changes in attitudes, values, and in the conditions of learning. In R.J. Blanchard & D.C. Blanchard (Eds.), *Advances in the study of aggression* (Vol. 1, pp. 139-173.) Orlando, FL: Academic Press.

Estrem, T.L. (2005). Relational and physical aggression among preschoolers: The effect of language skills and gender. *Early Education & Development, 16,* 207-231.

Fernald, A., Perfors, A., & Marchman, V. (2006). Picking up speed in understanding: Speech processing efficiency and vocabulary growth across the 2nd year. *Developmental* Psychology, 42, 98-116.

Ford, R.M., McDougall, S.J.P. & Evans, D. (2009). Parent-delivered compensatory education for children at risk of educational failure: Improving the academic and self-regulatory skills of a children at risk of educational failure: Improving the academic and self-regulatory skills of a Sure Start preschool sample. *British Journal of Psychology, 100,* 773-797.

Forehand, R., & Jones, D.J. (2002). The stability of parenting: A longitudinal analysis of inner-city African-American mothers. *Journal of Child and Family Studies, 11,* 455-467.

Foshee, V., & Bauman, K.E. (1992). Parental and peer characteristics as modifiers of the bond-behavior relationship: An elaboration of control theory. *Journal of Health and Social Behavior,* 33, 66-76.

Frazier, P.A., Barron, K.E., & Tix, A.P. (2004). Testing Moderator and Mediator Effects in Counseling Psychology Research. *Journal of Counseling Psychology, 51* (1), 115-134.

Frick, P.J., & Viding, E. (2009). Antisocial behavior from a developmental psychopathology perspective. *Development and Psychopathology, 21*, 1111-1131.

Ganger, J., & Brent, M. (2004). Reexamining the vocabulary spurt. *Developmental Psychology, 40,* 621-632.

Garon, N., Bryson, S., & Smith, I. (2008). A review of executive function in the preschool period using an integrative framework. *Psychological Bulletin, 134,* 31-60.

Gauthier, Y. (2003). Infant Mental Health as we enter the third millennium: Can we prevent aggression? *Infant Mental Health Journal, 24,* 296-308.

Gioia, G.A., Espy, K.A., & Isquith, P.K. (2003). *Behavior Rating Inventory of Executive Function – Preschool Version*. Odessa, Fla.: Psychological Assessment Resources, Inc.

Gioia, G. A., Isquith, P. K., Guy, S.C., & Kenworthy, L. (2000). Test review: Behavior rating inventory of executive function. *Child Neuropsychology, 6,* 235-238.

Gioia, G. A., Isquith, P. K., Kenworthy, L., & Barton, R. M. (2002). Profiles of everyday executive function in acquired and developmental disorders. *Neuropsychology, Development, and Cognition: Section C, Child Neuropsychology, 8*, 121–137.

Goldstein, S. & Naglieri, J.A. (2008). The school neuropsychology of ADHD: Theory, assessment and intervention. *Psychology in the Schools, 45,* 859-874.

Golla, J.K., Lee, R., & Coccaro, E.F. (2005). Developmental psychopathology and neurobiology of aggression. *Development and Psychopathology, 17,* 1151-1171.

Grusec, J.E., & Goodnow, J.J. (1994). Impact of parental discipline methods on the child's internalization of values: A reconceptualization of current points of view. *Developmental Psychology, 30,* 4-19.

Guttman-Steinmetz, S. & Crowell, J.A. (2006). Attachment and externalizing disorders: a developmental psychopathology perspective. *Journal of American Academic Child & Adolescent Psychiatry, 45,* 440-451.

Harris, P.L. (2006). Commentary: Use your words. *British Journal of Developmental Psychology, 24,* 253-261.

Hart, C.H., & Nelson, D.A. (1998). Overt and relational aggression in Russian nursery-school-age children: Parenting style and marital linkages. *Developmental Psychology, 34,* 687-697.

Hembree-Kigin, T.L. & McNeil, C.B. (1995). *Parent-Child Interaction Therapy*. New York, NY: Plenum Press.

Howell, D.C. *Statistical methods for psychology* (5th ed.). Pacific Grove, CA: Duxbury.

Hughes, C., Dunn, J., & White, A. (1998). Trick or treat? Uneven understanding of mind and emotion and executive dysfunction in "hard-to-manage" preschoolers. *Journal of Child Psychology, 29,* 498-510.

Hughes, C., & Ensor, R. (2006). Behavioural problems in 2-year-olds: Links with individual differences in theory of mind, executive function and harsh parenting. *Journal of Child Psychology and Psychiatry,47,* 488-497.

Hughes, C., & Graham, A. (2002). Measuring Executive Functions in Childhood: Problems and Solutions? *Child and Adolescent Mental Health, 7,* 131-142.

Junger, M., & Tremblay, R.E. (1999). Self-control, accidents, and crime. Criminal Justice and Behavior, 26, 485-501.

Kappenberg, E.S., & Halpern, D.F. (2006). Kinship Center attachment questionnaire: Development of a caregiver-completed attachment measure for children younger than 6 years. *Education and Psychological Measurement, 66,* 852-873.

Kaufmann, D., Gesten, E., Santa Lucia, R.C., Salcedo, O., Rendina-Gobioff, G., & Gadd, R. (2000). The relationship between parenting style and children's adjustment: The parents' perspective. *Journal of Child & Family Studies, 9,* 231-245.

Kenny, D.A. (2009, November 15). *Mediation,* Retrieved June 28, 2010 from http://davidakenny.net/cm/mediate.htm

Kimonis, E.R., Frick, P.J., Boris, N.W., Smyke, A.T., Cornell, A.H., Farell, J.M. & Zeanah, C.H. (2006). Callous-unemotional features, behavioral inhibition, and parenting: Independent predictors of aggression in a high-risk preschool sample. *Journal of Child and Family Studies, 15,* 745-756.

Kirkham, N.Z., & Diamond, A. (2003). Sorting between theories of perseveration: performance in conflict tasks requires memory, attention and inhibition. *Developmental Science, 6,* 474-476.

Kirkpatrick, L.A., & Shaver, P. (1990). Attachment theory and religion: Childhood attachments, religious beliefs and conversions. *Journal for the Scientific Study of Religion, 29,* 315-334.

Knowland, V.C.P., & Thomas, M.S.C. (2009). Sensitive periods in brain development: Implications for education policy. *European Psychiatric Review, 2,* 17-20.

Kochanska, G. (2001). Multiple pathways to conscience for children with different temperaments: From toddlerhood to age 5. *Developmental Psychology. Vol 33,* 228-240.

Kyung-Hye, L., Baillargeon, R.H., Vermunt, J.K., Wu, H.X., & Tremblay, R.E. (2007). Age differences in the prevalence of physical aggression among 5-11-year-old Canadian boys and girls. *Aggressive Behavior, 33,* 26-37.

LeBuffe, P.A., & Naglieri, J.A. (1999). Devereux Early Childhood Assessment User's Guide. Lewisville, NC. Kaplan Press.

Lewis, M., & Miller, S.M. (Eds.). (1990). *Handbook of developmental psychopathology.* New York, NY: Plenum Press.

Liebermann, D.P., Giesbrecht, G.F., & Muller, U. (2007). Cognitive and emotional aspects of self-regulation in preschoolers. *Cognitive Development, 22,* 511-529.

Liebermann, D.P. (2010). The Relation between executive function and motivational orientations via private speech in preschoolers. Unpublished doctoral dissertation, University of Victoria, Victoria, BC.

Lilly, J.R., Cullen, F.T., & Ball, R.A. (2007). *Criminological Theory: Context and Consequences (4th ed.).* Thousand Oaks, CA: Sage.

Loeber, R., & Hay, D. (1997). Key issues in the development of aggression and violence from childhood to early adulthood. *Annual Review of Psychology, 48,* 371-410.

Lynam, D., Moffitt, T.E, & Stouthamer-Loeber, M. (1993). Explaining the relation between IQ and delinquency: Class, race, test motivation, school failure, or self-control? *Journal of Abnormal Psychology, 102,* 187-196.

Lyons-Ruth, K., Alpern, L., & Repacholi, B. (1993). Disorganized infant attachment classification and maternal psychological problems as predictors of hostile-aggressive behavior in the preschool classroom. *Child Development, 64,* 572-585.

Lyons-Ruth, K. (1996). Attachment relationships among children with aggressive behavior problems: The role of disorganized early attachment patterns. *Journal of Consulting and Clinical Psychology, 64,* 64-73.

Mabry, J.L. (2005). Ecological validity of executive function in children: The relationship between the D-KEFS and the BRIEF. Unpublished doctoral dissertation, University of Virginia, Charlottesville, VA. (UMI No. 3189323)

Maccoby, E.E., & Martin, J.A. (1983). Socialization in the context of the family: Parent-child interaction. In P.H. Mussen (Series Ed.) & E.M. Hetherington (Vol. Ed.), *Handbook of Child Psychology: Vol. 4. Socialization, personality, and social development* (4th ed., pp. 1-101). New York: Wiley.

Main, M. & Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. In M.T. Greenberg, D. Cicchetti, & M.E. Cummings (Eds.), *Attachment in the preschool years: Theory, research, and intervention* (pp. 121-160). Chicago, IL: University of Chicago Press.

Maldonado-Molina, M.M., Reingle, J.M., Tobler, A.L., Jennings, W.G., & Komro, K.A. (2010). Trajectories of psychical aggression among Hispanic urban adolescents and young adults: An application of latent trajectory modelling from ages 12 to 18. *American Journal of Criminal Justice, 35,* 121-133.

Marcus, R.F., & Kramer, C. (2001). Reactive and proactive aggression: Attachment and social competence predictors. *Journal of Genetic Psychology, 162,* 260-275.

Matzke, D. Dolan, C.V., & Molenaar, D. (2010). The issue of power in the identification of "g" with lower-order factors. *Intelligence, 38,* 336-344.

Maughn, A., & Cicchetti, D. (2002). Impact of child maltreatment and interadult violence on children's emotion regulation abilities and socioemotional adjustment. *Child Development, 73,* 1525-1542.

Maughan, B., Pickles, A., Rowe, R., Costello, E., & Angold, A. (2000). Developmental trajectories of aggressive and non-aggressive conduct problems. *Journal of Quantitative Criminology, 16,* 199-221.

McCandless, S., & O'Laughlin, L. (2007). The clinical utility of the behavior rating inventory of executive function (BRIEF) in the Diagnosis of ADHD. *Journal of Attention Disorders, 10,* 381-389.

McDougall, P, Hymel, S., Vaillancourt, T, & Mercer, L. (2001). The consequences of childhood peer rejection. In Mark Leary (Ed.), *Interpersonal rejection* (pp. 213-147). Oxford University Press.

Moffitt, T.E, & Silva, P.A. (1988a). Neuropsychological deficit and self-reported delinquency in an unselected birth cohort. *Journal of the American Academy of Child & Adolescent Psychiatry, 27,* 233-240.

Moffitt, T.E, & Silva, P.A. (1988b). Self-reported delinquency, neuropsychological deficit, and history of attention deficit disorder. *Journal of Abnormal Child Psychology, 16,* 553-569.

Moffitt, T. E. (1990). Juvenile delinquency and Attention Deficit Disorder: Boys' developmental trajectories from age 3 to age 15. *Child Development, 61,* 893-910.

Moffitt, T. (1993). Adolescence-limited and life-course-persistent antisocial behaviour: A developmental taxonomy. *Psychological Review, 100,* 674-701.

Moss, E., Smolla, N., Cyr, C., Dubois-Comtois, K., Mazzarello, T., & Berthiaume, C. (2006). Attachment and behavior problems in middle childhood as reported by adult and child informants. *Development and Psychopathology, 18,* 425-444.

Muller, U., Jacques, S., Brocki, K., & Zelazo, P. D. (2009). The executive functions of language in preschool children. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 53-68). New York: Cambridge University Press.

Nagin, D. (1999). Analyzing developmental trajectories: A semiparametric, group-based approach. *Psychological Methods, 4,* 139-157.

Nagin, D., & Tremblay, R.E. (2001). Parental and early childhood predictors of persistent physical aggression in boys from kindergarten to high school. *Archives of General Psychiatry, 58,* 389-394.

Nagin, D., & Tremblay, R.E. (2005). Further reflections on modeling and analyzing developmental trajectories: A response to Maughn and Raudenbush. *Annals of the American Academy of Political and Social Science, 602,* 145-154.

NICHD Early Child Care Research Network. (2003). Does the amount of time spent in child care predict socioemotional adjustment during the transition to kindergarten? *Child Development, 74*, 976-1005.

Nicoll, M. (2001). The association between divorce and patterns of child adjustment (Master's Thesis). Unpublished doctoral dissertation, University of Saskatchewan, Saskatoon, SK.

Olweus, D. (1979). Stability of aggressive reaction patterns in males: A review. *Psychological Bulletin, 86*, 852-875.

Olweus, D. (1980). Familial and temperamental determinants of aggressive behavior in adolescent boys: A causal analysis. *Developmental Psychology, 16*, 644-660.

Olweus, D. (1984). Development of stable aggressive reaction patterns in males. In R.J. Blanchard & D.C. Blanchard (Eds.), *Advances in the study of aggression* (Vol. 1, pp. 139-173.) Orlando, FL: Academic Press.

Ouellette, G. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology, 98*, 554-566.

Palmer, C.D. (2009). Parenting style and self-control skills (PhD Dissertation). Available from Electronic Thesis and Dissertations Database. (UMI No. 3399525)

Patterson, G.R., DeBaryshe B.D., & Ramsey, E. (1989). A developmental perspective on antisocial behavior. *American Psychologist, 44,* 329-335.

Pedhazur, E.J. *Multiple regression in behavioral research: Explanation and prediction*. (2nd Ed.). Toronto, ON: Harcourt Brace College Publishers.

Pennington, B.F., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of Child Psychology and Psychiatry, 37,* 51-87.

Raaijmakers, M.A.J., Smidts, D.P., Sargeant, J.A., Maassen, G.H., Posthumus, J.A., Engeland, H., Matthys, W. (2008). Executive functions in preschool children with aggressive behaviour: Impairments in inhibitory control. *Journal of Abnormal Child Psychology, 36,* 1097-1107.

Reebye, P. (2005). Aggression during early years – Infancy and Preschool. *The Canadian Child and Adolescent Psychiatry Review, 14,* 16-20.

Renken, B., Egeland, B., Marvinney, D., Mangelsdorf, S., & Sroufe, L.A.. (1989). Early childhood antecedents of aggression and passive-withdrawal in early elementary school. *Journal of Personality, 57,* 257-281.

Rennie, D.A.C., Bull, R., & Diamond, A. (2004). Executive function in preschoolers: Reducing the inhibitory demands of the dimensional change card sort task. *Developmental Neuropsychology, 26,* 423-443.

Riggs, N.R., Greenberg, M.T., Kusche, C.A., & Pentz, M.A. The meditational role of neurocognition in the behavioural outcomes of a social-emotional prevention program in elementary school students: Effects of the PATHS curriculum. *Prevention Science, 7,* 91-101.

Robinson, C.C., Mandleco, B., Frost Olsen, S., & Hart, C.H. (1995). Authoritative, authoritarian, and permissive parenting practices: Development of a new measure. *Psychological Reports, 77,* 819-830.

Robinson, C. C., Mandleco, B., Olsen, S. F., & Hart, C. H. (2001). The parenting styles and dimensions questionnaire. In J. Toulioatos & B. Perlmutter (Eds.), Handbook of family measurement techniques (2nd ed.), Thousand Oaks, CA: Sage.

Royall, D.R., Lauterbach, E.C., Cummings, J.L., Reeve, A., Rummans, T.A., Kaufer, D.I., LaFrance, W.C., & Coffey, C.E. (2002). *Journal of Neuropsychiatry and Clinical Neuroscience, 14,* 377-405.

Rubin, K., Burgess, K., Dwyer, K., & Hastings, P. (2003). Predicting preschoolers' externalizing behaviours from toddler temperament, conflict and maternal negativity. *Developmental Psychology, 39,* 164-176.

Rutter, M. (2010). Child and adolescent psychiatry: past scientific achievements and challenges for the future. *European Child and Adolescent Psychiatry, 19,* 689-703.

Sakimura, J.N., Dang, M.T., Ballard, K.B., & Hansen, R.L. (2008). Cognitive and temperament Clusters in 3-to-5-year-old children with aggressive behavior. *Journal of School Health, 78,* 38-45.

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., & Boyce, W.T. (2011). Family socioeconomic status and child executive functions: The roles of language, home environment, and single parenthood. *Journal of the International Neuropsychological Society, 17,* 120-132.

Seguin, J. & Zelazo, P. (2005). Executive function in early physical aggression. In R. Tremblay, W. Hartup & J. Archer (Eds.), *Developmental origins of aggression* (pp. 306-329). New York: Guilford Publications.

Shaw, D.S., Gilliom, M., Ingoldsby, E., & Nagin, D. (2003). Trajectories leading to school-age conduct problems. *Developmental Psychology, 39,* 189-200.

Shaw, D.S., Keenan, K., & Vondra, J.I. (1994). Developmental precursors of externalizing behavior: Ages 1-3. *Developmental Psychology, 30,* 355-364.

Smith, P. (2004). Bullying: Recent developments. *Child and Adolescent Mental Health, 9,* 98-103.

Smokowski, P.R., & Kopasz, K.H. (2005). Bullying in school: An overview of types, effects, family characteristics, and intervention strategies. *Children & Schools, 27,* 101-110.

Soward, K.W. (2006). Reliance and self-control in at-risk preschool children: Influences of maternal parenting style and self-control. Unpublished doctoral dissertation, Fielding Graduate University, Santa Barbara, CA. (UMI No. 3205508)

Spere, K.A., Evans, M.A. Hendry, C., & Mansell, J. (2009). Language skills in shy and non-shy preschoolers and the effects of assessment context. *Journal of Child Language, 36,* 53-71.

Split, J.L., Koomen, H.M.Y., Thijs, J.T., Stoel, R.D., & Van der Leij, A. (2010). Teachers' assessment of antisocial behaviour in kindergarten: Physical aggression and measurement bias across gender. *Journal of Psychoeducational Assessment, 28,* 129-138.

Sprano, R., Riviera, C., Bolland, J.M. (2010). Are chronic exposure to violence and chronic violent behavior closely related developmental processes during adolescence? *Criminal Justice and Behavior, 37,* 1160-1179.

Sroufe, L.A., & Rutter, R. (1984). The domain of developmental psychopathology. *Child Development, 55,* 17-29.

Statistics Canada. (2007a). *Survey Overview for 2004/2005 Data Collection Cycle 6.* Retrieved November 22, 2007 from http://www.statcan.ca/english/sdds/document/4450_D2_T9_V2_E.pdf

Statistics Canada. (2007b). *Cycle 6 Survey Instruments 2004/2005 Book 1 - Parent, Child & Youth.* Retrieved November 22, 2007 from http://www.statcan.ca/english/sdds/instrument/4450_Q2_V5_E.pdf

Tabachnick, B.G., & Fidell, L.S. (2007). *Using Multivariate Statistics, 5th ed*. Boston: Allyn and Bacon.

Tamminga, C.A. (2000). Images in neuroscience. *American Journal of Psychiatry, 157,* 3.

Tardif, T. (1996). Nouns are not always learned before verbs: Evidence from Mandarin speakers' early vocabularies. *Developmental Psychology, 32*, 492-504.

Thomas, J. & Guskin, K. (2001). Disruptive behaviour in young children: What does it mean? *Journal of the Academy of Child & Adolescent Psychiatry, 40,* 44-51.

Thomas, M.S.C., & Johnson, M.H. (2008). New advances in understanding sensitive periods in brain development. *Current Directions in Psychological Science, 17,* 1-5.

Thompson, R.A. (2001). Snesitive periods in attachment. In D.B. Bailey, J.T. Bruer, F.J. Symons, & J.W. Lichtman (Eds.), *Critical thinking about critical periods* (pp. 83-106). Toronto, ON: Paul H. Brookes Publishing Co.

Tourigny, J. (2004). High risk environments and infant health: Predicting psychological and physical health outcomes with maternal, child, and parenting variables. Unpublished doctoral dissertation, University of Saskatchewan, Saskatoon, SK.

Trainor, W. J., Schactman, A., Hatton, L., Tourigny, J., & McKim, M. K. (2006). Predicting aggression: An examination from 18 to 42 months. World Association of Infant Mental Health: Paris, France, July 8-12, 2006.

Tremblay, R. E. (1999). When children's social development fails. In D.P. Keating, & C. Hertzman (Eds.), *Developmental health and the wealth of nations: Social, biological, and educational dynamics* (pp. 55-71). New York, NY: Guilford Press.

Tremblay, R.E. (2000). The development of aggressive behaviour during childhood: What have we learned in the past century? *International Journal of Behavioral Development*, *24*, 129-141.

Tremblay, R.E. (2001). The development of physical aggression during childhood and the prediction of later dangerousness. In G. Pinard & L. Pagani (Eds.), *Clinical assessment of dangerousness* (pp. 47-65). Cambridge University Press.

Trickett, P.K., & Kuczynski, L. (1986). Children's misbehaviors and parental discipline strategies in abusive and nonabusive families. *Developmental Psychology, 22,* 115-123.

Tsai, C. The effectiveness of exercise intervention on inhibitory control in children with developmental coordination disorder: Using a visuospatial attention paradigm as a model. *Research in Developmental Disabilities*, *30*, 1268-1280.

Unnever, J.D., Cullen, F.T., & Agnew, R. (2006). Why is "bad" parenting criminogenic? Implications from rival theories. *Youth Violence and Juvenile Justice, 4,* 3-33.

Vaillancourt, T., Miller, J.L., Fagbemi, J., Cote, S., & Tremblay, R.E. (2007). Trajectories and predictors of indirect aggression: Results from a nationally representative longitudinal study of Canadian children aged 2-10. *Aggressive Behavior, 33,* 1-13.

Vaillancourt, T., Brendgen, M., Boivin, M., & Tremblay, R.E. (2003). A longitudinal confirmatory factor analysis of indirect and physical aggression: Evidence of two factors over time? *Child Development, 74*, 1628-1638.

Vallotton, C., & Ayoub, C. (2010). Use your words: The role of language in the development of toddlers' self-regulation. *Early Childhood Research Quarterly, 26,* 169-181.

Villemarette-Pittman, N.R., Stanford, M.S., Greve, K.W. Language and executive function in self-reported impulsive aggression. *Personality and Individual Differences, 34,* 1533-1544.

Vygotsky, L. S. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Wadsworth, M.E.J. (1986). Effects of parenting style and preschool experience on children's verbal attainment: Results of a British longitudinal study. *Early Childhood Research Quarterly, 1,* 237-248.

Wallace, D.S.L. (2010). Violent delinquency in America - The determinants of carrying firearms among juveniles: A theoretical comparative analysis. Unpublished doctoral dissertation, Kansas State University, Manhattan, KS. (UMI No. 3389865)

Warner, R. (1963). *The Confessions of St. Augustine.* New York: Mentor-Omega.

Weiss, L.H., & Schwarz, J.C. (1996). The relationship between parenting types and older adolescents' personality, academic achievement, adjustment, and substance abuse. *Child Development, 67,* 2101-2114.

Welsh, M.C. (2002). Developmental and clinical variations in executive functions. In D.L. Molfese, & V.J. Molfese (Eds.), *Developmental variations in learning: Applications to social, executive function, language, and reading skills* (pp.139-185). Mahwah, NJ: Lawrence Erlbaum Associates.

Wertsch, J.V., & Tulviste, P. (1992). L.S. Vygotsky and contemporary developmental psychology. *Developmental Psychology, 28,* 548-557.

Wiebe, S.A., Sheffield, T., Nelson, J.M., Clark, C.A.C., Chevalier, N., Epsy, K.A. (2011). The structure of executive function in 3-year-olds. *Journal of Experimental Child Psychology, 108,* 436-452.

Zelazo, P.D., Carter, A., Reznick, J.S., & Frye, D. (1997). Early development of executive function: A problem-solving framework. *Review of General Psychology, 1,* 198-226.

Zelazo, P.D., & Frye, D. (1998). Cognitive complexity and control: II. The development of executive function in childhood. *Current Directions in Psychological Science, 7,* 121-126.

Zelazo, P.D., Frye, D., & Rapus, T. (1996). An age-related dissociation between knowing rules and using them. *Cognitive Development, 11,* 37-63.

Appendix A:

Study 1 Consent Forms (Teachers and Parents)

McMaster University

Department of Psychology

1280 Main Street West
Hamilton, Ontario, Canada
L8S 4K1

Phone: 905-525-9140
Ext. 23000
Fax: 905-529-6225
Email:psych@Mcmaster.ca
http://www.science.mcmaster.ca
/psychology

December, 2003

Study Title: Executive Functioning, Language Development, and Behavior Among Preschool Children

Principal Investigators: Tracy Vaillancourt, Ph.D., Assistant Professor, Department of Psychology, McMaster University; Larry Tuff, Ph.D., Assistant Professor, Department of Psychiatry and Neurosciences, McMaster University; Jean Clinton, M.D., Assistant Clinical Professor, Department of Psychiatry and Neurosciences, McMaster University. This study is conducted in partnership with McMaster University Children's Hospital and Affiliated Services for Children and Youth.

Research Sponsors: This study is being funded in part by the Department of Public Health and Community Services, Parent and Child Branch, City of Hamilton, the Hamilton Community Foundation, and the Trillium Foundation.

Purpose of Study: The purpose of this study is to examine the longitudinal (long-term) relationship between executive functioning skills, language development, and its links to behaviors such as helpfulness and aggression among preschool children. Executive functioning deals with flexibility and impulse control. It includes things such as being able to shift easily between activities, being able to plan and organize, and being able to control one's emotions. It also deals with something called working memory, which is the ability to remember 2 or more things at one time.

Study Procedures: You will be asked to fill out several questionnaires about specific children's behavior, executive functioning skills, and language development. Note that all the children you are asked about will have obtained parental permission to participate. Specifically, you will be asked to fill out: 1) the Child Behavior Checklist, which is a questionnaire about childhood behavior, emotions and language development, 2) the Behavior Ratings Inventory of Executive Functioning, which is a questionnaire about executive functioning (see above description), and 3) another questionnaire about your child's behavior which is taken from the National Longitudinal Study of Children and Youth. Examples of some of the questions being asked are: "How often would you say that _____ will try to help someone who has been hurt?; "How often would you say that _____ becomes upset with new situations?"; How often would you say that _____ demands a lot of attention?". It should take you about 30 minutes per child to fill out these questionnaires. To compensate for your time you will be paid $5.00 for each child's package.

In addition to collecting this information about specific children we will also be gathering more information about their vocabulary development. To do this, a trained research assistant will use two tests from the Wechsler Preschool and Primary Scale of Intelligence™-Third Edition (WPPSI-III) to asses the children's language skills. The WPPSI-III is an age-appropriate measure of language skills that has been used on many pre-school children in Canada. The two language tests will take about 7 minutes to complete. During these 7 minutes, the trained research assistant will first read a short, age-appropriate book to the child to ensure proper

rapport has been built. Next, the trained research assistant will ask the child to point to the picture that best represents the word spoken (i.e., "point to the cat"). Finally, the child will be shown some pictures and will be asked what the picture represents (i.e., "what is this?" when shown a drawn picture of a ball). The reading of the book and the administration of the language tests will be done in a quiet area of your classroom. The trained researcher and the participating child should always be in your field of view.

Confidentiality: All information gathered from you will be kept strictly confidential. We will only report group findings in reports. No individual results will ever be reported. Further, we will not identify the child care centre from which children were recruited and we will not share any of the information obtained from you with the children's parents or anyone else for that matter.

Potential Risks: There are no known risks to participating in this study.

Compensation: In recognition of your participation in this study you will be paid $5.00 per child for filling out the questionnaire package. Should you decide to stop participating, you will not receive any financial compensation

Contact: This project has been reviewed and received ethics clearance through the McMaster Research Ethics Board. If you have any questions or desire further information about this study, please contact Dr. Tracy Vaillancourt at 905-525-9140 or by email at vaillat@mcmaster.ca. If you have any concerns about your child's treatment or rights as a research participant, please contact Mr. Michael Wilson (McMaster Research Ethics Board) at 905-525-9140.

Consent: I understand that my participation in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without any consequences other than financial (see above compensation section). I understand that I may keep the enclosed copy of this sheet for my own records. My decision regarding this study is indicated below.

☐ Yes, I agree to participate in this study.

☐ No, I do not wish to participate in this study.

Name _____

Signature _____

Date _____

McMaster University

Department of Psychology
L8S 4K1

1280 Main Street West
Hamilton, Ontario, Canada
Fax: 905-529-6225

Phone: 905-525-9140
Ext. 23000

Email:psych@Mcmaster.ca
http://www.science.mcmaster.ca/psychology

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Purpose of Study: The purpose of this study is to examine the longitudinal (long-term) relationship between executive functioning skills, language development, and its links to behaviors such as helpfulness and aggression among preschool children. Executive functioning deals with flexibility and impulse control. It includes things such as being able to shift easily between activities, being able to plan and organize, and being able to control one's emotions. It also deals with something called working memory, which is the ability to remember 2 or more things at one time.

Study Procedures: In this phase of the study (Year 1), you and your child's teacher will be asked to fill out a few questionnaires about your child's behavior, executive functioning skills, and language development. Specifically, you and your child's teacher will be asked to fill out: 1) the Child Behavior Checklist, which is a questionnaire about childhood behavior, emotions, and language development, 2) the Behavior Ratings Inventory of Executive Functioning, which is a questionnaire about executive functioning (see above description), and 3) another questionnaire about your child's behavior which is taken from the National Longitudinal Study of Children and Youth. Examples of some of the questions being asked are: "How often would you say that _____ will try to help someone who has been hurt?; "How often would you say that _____ becomes upset with new situations?"; How often would you say that _____ demands a lot of attention?". Finally, you will also be asked to fill out a background information questionnaire which asks you questions like "What language(s) do you speak most often to your child at home?". It should take you about 30-40 minutes to fill out these questionnaires.

In addition to obtaining this information about your child from you and his/her teacher, we would also like to get more information about his/her vocabulary development. To do this, a trained research assistant will use two tests from the Wechsler Preschool and Primary Scale of Intelligence™-Third Edition (WPPSI-III) to asses you child's language skills. The WPPSI-III is an age-appropriate measure of language skills that has been used on many pre-school children in Canada. The two language tests will take about 7 minutes to complete. During these 7 minutes, the trained research assistant will first read a short, age-appropriate book to your child to ensure proper rapport has been built. Next, the trained research assistant will ask your child to point to the picture that best represents the word spoken (i.e., "point to the cat"). Finally, your child will be shown some pictures and will be asked what the picture represents (i.e., "what is this?" when shown a drawn picture of a ball). The reading of the book and the administration of the language tests will be done in a quiet

area of your child's classroom. The trained researcher and your child will always be in view of the classroom teacher(s).

Finally, because this is a longitudinal study, we would like to contact you again for participation at this time next year (2005) and in the following year (2006). As with this first phase of the study, we will provide you with a detailed description of the study and we will formally ask you for consent again. The procedures for years 2 and 3 of this study will be very similar to year 1 with a few minor changes. For example, we will include more age-appropriate questionnaires concerning your child's development.

Confidentiality: All information gathered from you, your child, and his/her teacher will be kept strictly confidential. We will only report group findings in reports. No individual results will ever be reported. Further, we will not identify the child care centre from which your child was recruited and we will not share any of the information obtained with your child's teacher or anyone else for that matter.

Potential Risks: While there are no known physical risks to participating in this study, some parents may feel a bit upset by filling out the questionnaires because the questions asked seem to highlight potential areas of concern. It is very clear that helping children early who have problems produces the best results. Should you have any concerns about your child's development you can contact *Heath Connections* at 905-546-3550 and speak with a public health nurse who can give you information about support in your community. Another potential risk of this study is that some children may feel uncomfortable answering questions posed by the trained research assistant. In the event that your child looks or behaves in a distressed manner (i.e., cries), the trained research assistant will immediately discontinue the task and thank him/her for participating. Moreover, should your child indicate that he/she does not want to participate their involvement with the study will end immediately.

Contact: This project has been reviewed and received ethics clearance through the McMaster Research Ethics Board. If you have any questions or desire further information about this study, please contact Dr. Tracy Vaillancourt at 905-525-9140 or by email at vaillat@mcmaster.ca. If you have any concerns about your or your child's treatment or rights as research participants, please contact Mr. Michael Wilson (McMaster Research Ethics Board) at 905-525-9140.

Consent: I understand that my participation in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without any consequences. I also understand I can withdraw my child from participating at any time during the course of the study by contacting Dr. Vaillancourt (using the information listed above). I understand that my child can also choose to withdraw from participating at any time (see potential risk section) without any consequences. Finally, I understand that I may keep the enclosed copy of this sheet for my own records. My decision regarding this study is indicated below.

☐ Yes, I agree to participate and my child has my permission to participate.

☐ No, I do not wish to participate and my child does not have my permission to participate.

Name of child _____ Age of child _____

Parent or Guardian Signature _____ Date_____

Appendix B:

Study 1 Debriefing

McMaster University

Department of Psychology

1280 Main Street West
Hamilton, Ontario, Canada
L8S 4K1

Phone: 905-525-9140
Ext. 23000
Fax: 905-529-6225
Email:psych@Mcmaster.ca
http://www.science.mcmaster.ca/psychology

For Your Records (Debriefing Form)

You have just completed a number of surveys about your child's executive functioning skills, language development and behavior. In this study, we are interested in understanding how these things relate to each other as children are developing these skills. The reason we have used surveys in this study is because they are a convenient way of collecting information about a lot of people.

- If you have any questions about the about this study please feel free to contact Dr. T. Vaillancourt, Department of Psychology, (905) 525-9140 ext. 27866 or at vaillat@mcmaster.ca .
- If you are interested in the results of this study please refer to the following web-site but note that no individual results will be made available, only group findings. http://www.science.mcmaster.ca/Psychology/vaillancourt/index.htm
- Should you have any concerns about your child's development you can contact *Heath Connections* at 905-546-3550 and speak with a public health nurse who can give you information about support in your community.
- Finally, if you have any concerns about your rights and treatment as a participant in a research study please contact Mr. Michael Wilson, Office Research Services (905) 525-9140 ext. 23142, srebsec@mcmaster.ca .

Thank you for your time and co-operation!

Appendix C:

Study 1 Background Information

Background Information

The following Statistics Canada Census questions are asked because many psychological journals are now requiring that a description about participants' background is given so that the reader can make links to the populations they study and/or serve. For example, a study that includes only English speaking, African-Canadian children from wealthy homes may not represent the realities of children from other language or cultural groups. In order to see how the findings may relate to other groups of children we need to describe our participants' background, which is why we are asking the following questions.

This information will only be used for descriptive purpose. No individual information will be shared. Further, should your personal circumstances place you in a small group in which there are not many people, we will combine your group with another one to ensure your confidentiality.

1. What is the **highest** level of education you have ever attained? *Please Check ONE*

_____ Some High School

_____ Completed High School

_____ Some Trade, Technical or Vocational School or Business College

_____ Some Community College, CEGEP or Nursing School

_____ Some University

_____ Diploma or Certificate from Community College, CEGEP or Nursing School or University

_____ Diploma or Certificate from Trade, Technical or Vocational School or Business College

_____ Bachelor or Undergraduate Degree or Teacher's College (e.g., B.A., B.Sc. B.A.Sc., B.Ed.)

_____ Master's (e.g., M.A., M.Sc., M. Ed.)

_____ Degree in Medicine, Dentistry, Veterinary Medicine, Optometry or Law

_____ Earned Doctorate

_____ Other (Specify) _____

2. How would you describe your current employment position?

_____

3. Please estimate in which of the following groups your household income falls?

less than $5,000	____	less than $40,000	____
less than $10,000	____	less than $50,000	____
less than $15,000	____	less than $60,000	____
less than $20,000	____	less than $70,000	____
less than $30,000	____	> $80,000	____

4. What is the primary language spoken to your child at home? The primary language spoken is the one you use most often when speaking to your child.

____English
____French
____Arabic
____Chinese
____Cree
____German
____Greek
____Hungarian
____Italian
____Korean
____Persian (Farsi)
____Polish
____Portuguese
____Punjabi
____Spanish
____Tagalog (Filipino)
____Ukrainian
____Vietnamese
____Other (please specify)
_____

5. How would you best describe your ethnic or cultural heritage?

____White
____Chinese
____South Asian (e.g., East Indian, Pakistani, Punjabi, Sri Lankan)
____Black (e.g., African, Haitian, Jamaican, Somali)
____Native/Aboriginal People (North American Indian, Métis or Inuit/Eskimo)
____Arab/West Asian (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan)
____Filipino
____South East Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)
____ Latin-American
____Japanese
____Korean
____Other (please specify) _____

6. In what country where you born? _____

7. What is your current marital status?

____Single ____Common Law ____Married ___Legally Separated ____Divorced ____Widowed

8. How old are you?

____younger than 18 years
____18-20
____21-25
____26-30
____31-35
____36-40
____41-45
____46-50
____51-55
____56-60
____older than 61years

Appendix D:

Child Behaviour Survey (Physical Aggression Items) – Study 1

CBS

Instructions: Using the answers "never or not true", "sometimes or somewhat true" or "often or very true", how often would you say that your child does the following? Please answer all of the questions and indicate your response by circling the appropriate response.

1. Gets into many fights?	never or not true	sometimes or somewhat true	often or very true
2. Kicks, bites, hits other children?	never or not true	sometimes or somewhat true	often or very true
3. Physically attacks people?	never or not true	sometimes or somewhat true	often or very true

Appendix E:

Study 1 Regression Statistics

Study 1 Regression Analyses with Inhibition and Language as Predictors of Physical Aggression

Predictor Variables	**Standard Coefficient β**	**F-Test of Overall Model**	**F-Test of Regression Model (Steps)**
Time 1 parent-reported physical aggression		**R^2 = 0.122, F (3, 301) = 13.922, p < 0.001**	
Step 1			R^2 = 0.015, F (2, 302) = 2.319, p = 0.10
T1 Expressive	0.094		
T1 Receptive	-0.024		
Step 2			**R^2-*Change* = 0.122, F-*Change* (1, 301) = 36.581, p < 0.001**
T1 Parent Inhibit	**0.332**		
Time 1 parent-reported physical aggression		**R^2 = 0.122, F (3, 301) = 13.922, p < 0.001**	
Step 1			**R^2 = 0.116, F (1, 303) = 39.652, p < 0.001**
T1 Parent Inhibit	**0.332**		
Step 2			R^2-*Change* = 0.006, *F-Change* (2, 301) = 1.050, p = 0.351
T1 Receptive	-0.024		
T1 Expressive	0.094		

Note: All significant (p < 0.05) values are in bold

Appendix E (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 teacher-reported physical aggression		**R^2 = 0.439, F (3, 372) = 97.193, p < 0.001**	
Step 1			**R^2 = 0.018, F (2, 373) = 3.467, p = 0.032**
T1 Expressive	0.051		
T1 Receptive	-0.064		
Step 2			**R^2-Change = 0.421, F-Change (1,372) = 279.470, p < 0.001**
T1 Teacher Inhibit	**0.664**		
Time 1 teacher-reported physical aggression		**R^2 = 0.439, F (3, 372) = 97.193, p < 0.001**	
Step 1			**R^2 = 0.437, F (1, 374) = 290.652, p < 0.001**
T1 Teacher Inhibit	**0.664**		
Step 2			R^2-*Change* = 0.002, *F-Change* (2, 372) = 0.698, p = 0.498
T1 Receptive	-0.064		
T1 Expressive	0.051		

Note: All significant ($p < 0.05$) values are in bold

Appendix E (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 parent-reported physical aggression		**R^2 = 0.072, F (3, 297) = 7.657, p < 0.001**	
Step 1			R^2 = 0.016, F (2,298) = 2.467, p = 0.087
T1 Expressive	0.087		
T1 Receptive	-0.001		
Step 2			**R^2-Change = 0.056, F-Change (1, 297) = 17.759, p < 0.001**
T1 Teacher Inhibit	**0.240**		
Time 1 parent-reported physical aggression		**R^2 = 0.072, F (3, 297) = 7.657, p < 0.001**	
Step 1			**R^2 = 0.064, F (1,299) = 20.591, p < 0.001**
T1 Teacher Inhibit	**0.240**		
Step 2			R^2-*Change* = 0.007, *F-Change* (2, 297) = 1.178, p = 0.309
T1 Receptive	-0.001		
T1 Expressive	0.087		

Note: All significant ($p < 0.05$) values are in bold

Appendix E (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 teacher-reported physical aggression		**R^2 = 0.082, F (3, 304) = 9.091, p < 0.001**	
Step 1			**R^2 = 0.022, F (2, 305) = 3.412, p = 0.034**
T1 Expressive	0.131		
T1 Receptive	-0.021		
Step 2			**R^2-*Change* = 0.060, F-*Change* (1, 304) = 20.023, p < 0.001**
T1 Parent Inhibit	**0.249**		
Time 1 teacher-reported physical aggression		**R^2 = 0.082, F (3, 304) = 9.091, p < 0.001**	
Step 1			**R^2 = 0.069, F (1, 306) = 22.534, p < 0.001**
T1 Parent Inhibit	**0.249**		
Step 2			R^2-*Change* = 0.014, *F-Change* (2, 302) = 2.275, p = 0.105
T1 Receptive	-0.021		
T1 Expressive	0.131		

Note: All significant ($p < 0.05$) values are in bold

Appendix E (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 2 parent-reported physical aggression		**R^2 = 0.350, F (3, 58) = 10.404, p < 0.001**	
Step 1			R^2 = 0.008, F (2, 59) = 0.246, p = 0.783
T2 Expressive	0.233		
T2 Receptive	-0.078		
Step 2			**R^2-*Change* = 0.342, F-*Change* (1, 58) = 30.474, p < 0.001**
T2 Parent Inhibit	**0.599**		
Time 1 parent-reported physical aggression		**R^2 = 0.350, F (3, 58) = 10.404, p < 0.001**	
Step 1			**R^2 = 0.314, F (1, 60) = 27.496, p < 0.001**
T2 Parent Inhibit	**0.599**		
Step 2			R^2-*Change* = 0.036, *F Change* (2, 58) = 1.588, p = 0.213
T2 Receptive	-0.078		
T2 Expressive	0.233		

Note: All significant (p < 0.05) values are in bold

Appendix E (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 2 parent-reported physical aggression		**R^2 = 0.239, F (3, 47) = 4.932, p = 0.005**	
Step 1			R^2 = 0.013, F (2, 48) = 0.307, p = 0.737
T2 Expressive	0.070		
T2 Receptive	0.014		
Step 2			**R^2-Change = 0.227, F-Change (1, 47) = 14.016, p < 0.001**
T2 Teacher Inhibit	**0.487**		
Time 2 parent-reported physical aggression		**R^2 = 0.239, F (3, 47) = 4.932, p = 0.005**	
Step 1			**R^2 = 0.233, F (1, 49) = 14.890, p < 0.001**
T2 Teacher Inhibit	**0.487**		
Step 2			R^2-*Change* = 0.006, F-*Change* (3, 47) = 0.197, p = 0.822
T2 Receptive	0.014		
T2 Expressive	0.070		

Note: All significant ($p < 0.05$) values are in bold

Appendix F:

Study 2 General Instructions & Consent

General Instructions

We would like to thank you for your interest in this research. Please remember that there are no right or wrong answers, just do your best to answer each item as honestly as you can.

Confidentiality and privacy will be strictly protected and all answers will remain anonymous. Please *DO NOT* put your name or any other identifying information anywhere on the questionnaires, other than on the next page. This page will be separated from the rest of the package later, as all information is to remain anonymous. An ID number will be assigned in order to match your name with your responses, however, to allow for us to track your current responses with future research, if you choose to participate again at a later date. Only the student researcher and his supervisor will see the questionnaires.

We would like you to help us by completing a set of questionnaires which you will find in this package. Please read all the instructions carefully before completing each questionnaire. If at any time during participation that you feel unable to continue, you are free to terminate your participation and all information that you have provided up until that point will be destroyed. Also, you are free to omit any questions that you do not feel comfortable answering.

The following questionnaires concern your child's behaviour, their thinking ability, as well as the relationship you have with your child and your personal parenting beliefs and practices.

CONSENT FORM - PARENTS

You are invited to participate in a research project entitled "**Learning, Communicating and Playing: A Study of Early Childhood**". Please read this form carefully, and feel free to ask questions you might have.

Researchers: Joe Trainor (joe.trainor@usask.ca) and Dr. Patricia McDougall (patti.mcdougall@usask.ca or 966-8957), Department of Psychology, University of Saskatchewan / St. Thomas More College.

Purpose and Procedure: The purpose of this study is to examine relationships involving children's behaviour (e.g., physical aggression), executive function (i.e., working memory, delay of gratification, planning, attention, and impulse control), attachment (type of relationship to caregivers) and parenting styles. The information that you provide today will help us understand factors that lead to the development of problematic behaviour among preschool children.
We invite you and your child to participate by:
a) you completing a series of questionnaires at home. The first questionnaire contains general questions, such as age and gender. The other questionnaires concern your child's behaviour, their thinking ability, your relationship with your child and your personal parenting practices and beliefs. These questionnaires should take approximately **20-30 minutes** of your time.
b) your child answering some questions (orally) and interacting with a trained researcher at his / her daycare, so that we can measure his / her vocabulary ability. This portion of the study will take approximately **10-30 minutes**.

The findings of the research will be used as part of a PhD dissertation, and may be reported in an academic journal, or at an academic conference. Data will always be reported in aggregate (i.e., summarized) form. No information about individual participants will be provided.

Potential Benefits: The information that you provide will contribute to an understanding of factors that lead to the development of problematic behaviour among preschool children. All parents who agree to participate in this study will be thanked with a $5 gift certificate from Tim Horton's. A toy will also be donated to all participating daycares.

Potential Risks: It is possible that the questionnaires may highlight concerns about your children. This may be upsetting to some. Thus, all parents and daycares will be provided with some referrals in the Saskatoon area, to be contacted at the discretion of the parents.

During vocabulary testing, children will remain in view of daycare staff. Typically children find the tasks associated with this test to be fun. However, it is possible that some children may not enjoy the test. If a child appears distressed at any time, or it seems that they do not wish to do the testing, testing will be discontinued.

Storage of Data: All original data will be stored for five years after the completion of the project. During this time, data will be kept in a locked filing cabinet in the supervising researcher's laboratory. When the data is no longer required the data will be appropriately destroyed

Confidentiality: The **confidentiality** of all results will be preserved both during and following completion of the study. Parents, daycare staff and children will all be assigned ID numbers, so that the data from this portion of the study can be matched with future data, if you choose to participate in a second part of the study (in approximately one year's time). You should **not** put your name or any other identifying information on any of the questionnaires.

Right to Withdraw: Your participation is voluntary, and you can answer only those questions that you are comfortable with. There is no guarantee that you will personally benefit from your involvement. The information that is shared will be held in strict confidence and discussed only with the research team. You may withdraw from the research project for any reason, at any time, without penalty of any sort. Parents who withdraw will still be thanked with a $5 gift certificate from Tim Horton's. If you withdraw from the research project at any time, any data that you have contributed will be destroyed at your request. By agreeing to participate in this portion of the study, you are not in any way expected to participate in a second phase of data collection (in approximately one year). At this time, you will be contacted and once again be given information about the study at this time, and asked whether or not you would like to provide further participation.

Questions: If you have any questions concerning the research project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided (above) if you have other questions. This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board in September, 2008. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect.

Follow-Up or Debriefing:
Following the completion of data collection at Time 2, all participating parents and daycare providers will be offered an information package on physical aggression. Moreover, following Time 2 data analyses, the primary researcher will offer an evening symposium on the results of this study, open to all participating parents and daycare providers.

Consent to Participate:
I have read and understood the description provided; I have had an opportunity to ask questions and my/our questions have been answered. I consent to participate in the research project, and

provide consent for my child to participate, understanding that I may withdraw my consent at any time. A copy of this Consent Form has been given to me for my records.

_____	_____
(Name of Parent)	(Date)
_____	_____
(Name of Child)	(Date)
_____	_____
(Signature of Participant)	(Signature of Researcher)

***Please note*, unless you have agreed to participate in this research, there is no need for you to return the consent form.**

If you do wish to participate in this research, you can return this consent form to a staff member at your child's daycare (where you received this form). You will then be provided with an envelope containing research questionnaires.

Thank you for taking the time to read this form and for considering participation!

CONSENT FORM – DAYCARE STAFF

You are invited to participate in a research project entitled "**Learning, Communicating and Playing: A Study of Early Childhood**". Please read this form carefully, and feel free to ask questions you might have.

Researchers: Joe Trainor (joe.trainor@usask.ca) and Dr. Patricia McDougall (patti.mcdougall@usask.ca or 966-8957), Department of Psychology, University of Saskatchewan / St. Thomas More College.

Purpose and Procedure: The purpose of this study is to examine relationships involving children's behaviour (e.g., physical aggression), executive function (i.e., working memory, delay of gratification, planning, attention, and impulse control), attachment (type of relationship to caregivers) and parenting styles. The information that you provide today will help us understand factors that lead to the development of problematic behaviour among preschool children.
We invite you and the children at your daycare to participate by:
a) you completing a series of questionnaires. The questionnaires concern each child's behaviour and thinking ability. These questionnaires should take approximately **10-15 minutes** of your time.
b) The child answering some questions (orally) and interacting with a trained researcher at the daycare, so that we can measure his / her vocabulary ability. This portion of the study will take approximately **10 -30 minutes**.

The findings of the research will be used as part of a PhD dissertation, and may be reported in an academic journal, or at an academic conference. Data will always be reported in aggregate (i.e., summarized) form. No information about individual participants will be provided.

Potential Benefits: The information that you provide will contribute to an understanding of factors that lead to the development of problematic behaviour among preschool children. All daycare staff who participate will be thanked with a payment of $5 per questionnaire package (that is, per child), and a toy will also be donated to all participating daycares.

Potential Risks: It is possible that the questionnaires may highlight concerns about the children you work with. This may be upsetting to some. Thus, all parents and daycares will be provided with some referrals in the Saskatoon area, to be contacted at the discretion of the parents.

Storage of Data: All original data will be stored for five years after the completion of the project. During this time, data will be kept in a locked filing cabinet in the supervising researcher's laboratory. When the data is no longer required the data will be appropriately destroyed

Confidentiality: The **confidentiality** of all results will be preserved both during and following completion of the study. Parents, daycare staff and children will all be assigned ID numbers, so that the data from this portion of the study can be matched with future data, if you choose to participate in a second part of the study (in approximately one year's time). You should **not** put your name or any other identifying information on any of the questionnaires.

Right to Withdraw: Your participation is voluntary, and you can answer only those questions that you are comfortable with. There is no guarantee that you will personally benefit from your involvement. The information that is shared will be held in strict confidence and discussed only with the research team. You may withdraw from the research project for any reason, at any time, without penalty of any sort. As a daycare provider, if you withdraw, a toy will still be donated to your daycare, and you will still be thanked with a payment of $5 per child. If you withdraw from the research project at any time, any data that you have contributed will be destroyed at your request. By agreeing to participate in this portion of the study, you are not in any way expected to participate in a second phase of data collection (in approximately one year). At this time, you will be contacted and once again be given information about the study at this time, and asked whether or not you would like to provide further participation.

Questions: If you have any questions concerning the research project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided (above) if you have other questions. This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board in September, 2008. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect.

Follow-Up or Debriefing:
Following the completion of data collection at Time 2, all participating parents and daycare providers will be offered an information package on physical aggression. Moreover, following Time 2 data analyses, the primary researcher will offer an evening symposium on the results of this study, open to all participating parents and daycare providers.

Consent to Participate:
I have read and understood the description provided; I have had an opportunity to ask questions and my/our questions have been answered. I consent to participate in the research project, understanding that I may withdraw my consent at any time. A copy of this Consent Form has been given to me for my records.

_____	_____
(Name of Participant)	(Date)
_____	_____
(Signature of Participant)	(Signature of Researcher)

Appendix G:

Study 2 Background Information

Background Information

1. How old is your child? _____ Years _____ Months

2. What is your child's sex? _____ Female _____ Male

3. How many adults live in the child's home? _____

4. How many other children live in the child's home with him/her? _____

5. What is your relationship to the child?

_____ Mother

_____ Father

_____ Adoptive Mother

_____ Adoptive Father

_____ Foster Mother

_____ Other (please specify) _____

5. What is your first language (your mother tongue)?

_____ English

_____ French

_____ Cree

_____ Other (please specify) _____

6. Which of the following languages are spoken in the home?

_____ English

_____ French

_____ Cree

_____ Other (please specify) _____

Appendix H:

Child Behaviour Survey (Physical Aggression Items) – Study 2

CBS

Instructions: Using the answers "never or not true", "sometimes or somewhat true" or "often or very true", how often would you say that your child does the following? Please answer all of the questions and indicate your response by circling the appropriate response.

1. Gets into many fights?	never or not true	sometimes or somewhat true	often or very true
2. Kicks, bites, hits other children?	never or not true	sometimes or somewhat true	often or very true
3. Reacts with anger and fighting?	never or not true	sometimes or somewhat true	often or very true

Appendix I:

The Parenting Styles and Dimensions Questionnaire

PSDQ

Directions: This Questionnaire is designed to measure behaviours you show towards your child.

Example: Please read each item on the questionnaire and think about how often you show this behaviour and place your answer on the line to the left of the item.

___3___ 1. I allow my child to choose what to wear to school.

I SHOW THIS BEHAVIOUR:
1 = Never
2 = Once in Awhile
3 = About Half of the Time
4 = Very Often
5= Always

Rate each item according to how often you use this behaviour with your child.

I SHOW THIS BEHAVIOUR:
1 = Never
2 = Once in Awhile
3 = About Half of the Time
4 = Very Often
5= Always

_____ 1. I am responsive to my child's feelings and needs.

_____ 2. I use physical punishment as a way of disciplining my child.

_____ 3. I take my child's wishes into account before asking the child to do something.

_____ 4. When my child asks why he/she has to conform, I state because I said so, or I am your mother/father and I want you to.

_____ 5. I explain to my child how I feel about the child's good and bad behaviour.

_____ 6. I spank when my child is disobedient.

_____ 7. I encourage my child to talk about his/her troubles.

I SHOW THIS BEHAVIOUR:

1 = Never
2 = Once in Awhile
3 = About Half of the Time
4 = Very Often
5= Always

_____ 8. I find it difficult to discipline my child.

_____ 9. I encourage my child to freely express himself/herself even when disagreeing with me.

_____ 10. I punish by taking privileges away from my child with little if any explanations.

_____ 11. I emphasize the reasons for rules.

_____ 12. I give comfort and understanding when my child is upset.

_____ 13. I yell or shout when my child misbehaves.

_____ 14. I give praise when my child is good.

_____ 15. I give into my child when the child causes a scene about something.

_____ 16. I lose my temper with my child.

_____ 17. I threaten my child with punishment more often than actually giving it.

_____ 18. I take into account my child's preferences in making plans for the family.

_____ 19. I grab my child when being disobedient.

_____ 20. I state punishments to my child and do not actually do them.

_____ 21. I show respect for my child's opinions by encouraging my child to express them.

_____ 22. I allow my child to give input into family rules.

_____ 23. I scold and criticize to make my child improve.

_____ 24. I spoil my child.

_____ 25. I give my child reasons why rules should be obeyed.

_____ 26. I use threats as punishment with little or no justification.

I SHOW THIS BEHAVIOUR:
1 = Never
2 = Once in Awhile
3 = About Half of the Time
4 = Very Often
5= Always

_____ 27. I have warm and intimate times together with my child.

_____ 28. I punish by putting my child off somewhere alone with little if any explanations.

_____ 29. I help my child to understand the impact of behaviour by encouraging my child to talk about the consequences of his/her own actions.

_____ 30. I scold or criticize when my child's behaviour doesn't meet my expectations.

_____ 31. I explain the consequences of the child's behaviour.

_____ 32. I sway my child when the child misbehaves.

Appendix J:

Kinship Center Attachment Questionnaire

KCAQ

Directions: Please read each item below and circle the number that you think **BEST** describes how often your child behaves as described in the item. Please answer all questions and circle only one number for each item. If you make a mistake, please put an "X" through the mistake and circle the right number. Please rate your child based on his/her current behavior.

0 never/rarely	**1** once in a while	**2** occasionally	**3** sometimes	**4** often	**5** usually	**6** almost always

1.	My child is *very* clingy	**0 1 2 3 4 5 6**
2.	If things don't go his/her way, my child gets very upset	**0 1 2 3 4 5 6**
3.	When my child gets hurt, he/she refuses to let anyone comfort him/her	**0 1 2 3 4 5 6**
4.	My child understands what is said to him/her	**0 1 2 3 4 5 6**
5.	My child learns from his/her mistakes and stops a behavior when that behavior results in a negative consequence	**0 1 2 3 4 5 6**
6.	When my child is in pain, he/she doesn't show it	**0 1 2 3 4 5 6**
7.	My child is kind and gentle with animals	**0 1 2 3 4 5 6**
8.	My child does not like being separated from me except on his/her terms	**0 1 2 3 4 5 6**
9.	My child is *very* whiny	**0 1 2 3 4 5 6**

0 never/rarely	**1** once in a while	**2** occasionally	**3** sometimes	**4** often	**5** usually	**6** almost always

10. My child talks as well as other children of the same age **0 1 2 3 4 5 6**

11. When my child is upset, he/she does not allow familiar adults to comfort him/her, but will go to strangers for comfort **0 1 2 3 4 5 6**

12. My child teases, hurts, or is cruel to other children **0 1 2 3 4 5 6**

13. My child hoards food or has other unusual eating habits (e.g., eats paper, raw flour, packaged mixes, feces, etc.) **0 1 2 3 4 5 6**

14. My child destroys or breaks his/her own things **0 1 2 3 4 5 6**

15. My child destroys or breaks things that belong to others **0 1 2 3 4 5 6**

16. My child has an easy time making and keeping friends **0 1 2 3 4 5 6**

17. My child steals things and doesn't seem to feel bad about his/her behaviour **0 1 2 3 4 5 6**

18. My child seems overly interested in fire, gore, and blood **0 1 2 3 4 5 6**

19. My child has told others that I abuse him/her even though I never have **0 1 2 3 4 5 6**

20. My child plays well with other children **0 1 2 3 4 5 6**

Appendix K:

Study 2 Debriefing (Parents and Teachers)

Debriefing Information

Thank you for participating in this research project!!! Your participation will contribute to a better understanding of factors that relate to problematic behaviour among preschool children.

Once this study has been completed, a summary of results will be made available to all participants. If you would like to receive this information please contact the principal investigator, Joe Trainor by email at **joe.trainor@usask.ca**.

If you experience any discomfort or have any further questions as a result of completing this study, please contact either the principal investigator, or Dr. P. McDougall (supervisor) at **patti.mcdougall@usask.ca.** Our mailing address is:

Department of Psychology
Arts & Sciences Building
University of Saskatchewan
Saskatoon, Saskatchewan
S7N-5A5

Thank you again!

Suggested Readings that relate to this study:

Dodge, K.A., Coie, J.D., & Lynam, D. (2006). Aggression and antisocial behaviour in youth. In W. Damon (Series Ed.), R.M. Lerner (Series Ed.), & N. Eisenberg (Vol. Ed.), *Handbook of Child Psychology: Vol. 3. Social, Emotional, and Personality Development*, (6th ed., pp. 719-788). New York: Wiley.

Shaw, D.S., Keenan, K., & Vondra, J.I. (1994). Developmental precursors of externalizing behavior: Ages 1-3. *Developmental Psychology*, *30*, 355-364.

Tremblay, R.E. (2000). The development of aggressive behaviour during childhood: What have we learned in the past century? *International Journal of Behavioral Development*, *24*, 129-141.

Appendix L:

Study 2 Regression Statistics

Study 2 Regression Analyses with Three Indices of Executive Function and Attachment as Predictors of Physical Aggression

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 parent-reported physical aggression		**R^2 = 0.334, Adjusted R^2 = 0.254, F (3, 33) = 4.144, p = 0.008**	
Step 1			**R^2 = 0.181, Adjusted R^2 = 0.158, F (1, 36) = 7.936, p = 0.008**
T1 Attachment	-0.121		
Step 2			R^2-*Change* = 0.154, *F-Change* (3, 33) = 2.541, p = 0.073
T1 Parent Inhibit	**0.032**		
T1 Parent Shift	0.018		
T1 Parent EC	0.011		
Time 1 parent-reported physical aggression		**R^2 = 0.334, Adjusted R^2 = 0.254, F (3, 33) = 4.144, p = 0.008**	
Step 1			**R^2 = 0.328, Adjusted R^2 = 0.268, F (3, 34) = 5.523, p = 0.003**
T1 Parent Inhibit	**0.032**		
T1 Parent Shift	0.018		
T1 Parent EC	0.011		
Step 2			R^2-*Change* = 0.007, *F-Change* (1, 33) = 0.333, p = 0.568
T1 Attachment	-0.121		

Note: All significant ($p < 0.05$) values are in bold

Appendix L (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 teacher-reported physical aggression		**R^2 = 0.720, Adjusted R^2 = 0.669, F (3, 22) = 14.114, p < 0.001**	
Step 1			**R^2 = 0.229, Adjusted R^2 = 0.198, F (1, 25) = 7.423, p = 0.012**
T1 Attachment	0.208		
Step 2			**R^2-*Change* = 0.491, F-*Change* (3, 22) = 12.831, p < 0.001**
T1 Teacher Inhibit	0.067		
T1 Teacher Shift	-0.095		
T1 Teacher EC	**0.779**		
Time 1 teacher-reported physical aggression		**R^2 = 0.720, Adjusted R^2 = 0.669, F (3, 22) = 14.114, p < 0.001**	
Step 1			**R^2 = 0.685, Adjusted R^2 = 0.644, F (3, 23) = 16.666, p < 0.001**
T1 Teacher Inhibit	0.067		
T1 Teacher Shift	-0.095		
T1 Teacher EC	**0.779**		
Step 2			
T1 Attachment	0.208		R^2-*Change* = 0.113, *F-Change* (1, 22) = 2.719, p = 0.113

Note: All significant (p < 0.05) values are in bold

Appendix L (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 parent-reported physical aggression		**R^2 = 0.466, Adjusted R^2 = 0.369, F (4, 22) = 4.799, p = 0.006**	
Step 1			**R^2 = 0.218, Adjusted R^2 = 0.187, F (1, 25) = 6.969, p = 0.014**
T1 Attachment	0.269		
Step 2			**R^2-*Change* = 0.248, F-*Change* (3, 22) = 3.405, p = 0.036**
T1 Teacher Inhibit	0.093		
T1 Teacher Shift	-0.479		
T1 Teacher EC	**0.667**		
Time 1 parent-reported physical aggression		**R^2 = 0.466, Adjusted R^2 = 0.369, F (4, 22) = 4.799, p = 0.006**	
Step 1			**R^2 = 0.408, Adjusted R^2 = 0.331, F (3, 23) = 5.285, p = 0.006**
T1 Teacher Inhibit	0.093		
T1 Teacher Shift	-0.479		
T1 Teacher EC	**0.667**		
Step 2			R^2-*Change* = 0.058, *F-Change* (1, 22) = 2.386, p = 0.137
T1 Attachment	0.269		

Note: All significant ($p < 0.05$) values are in bold

Appendix L (con't)

Predictor Variables	Standard Coefficient β	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 1 teacher-reported physical aggression		R^2 = 0.245, Adjusted R^2 = 0.107, F (4, 22) = 1.783, p = 0.168	
Step 1			**R^2 = 0.213, Adjusted R^2 = 0.181, F (1, 25) = 6.765, p = 0.015**
T1 Attachment	0.412		
Step 2			R^2-*Change* = 0.032, *F-Change* (3, 22) = 0.309, p = 0.819
T1 Parent Inhibit	0.063		
T1 Parent Shift	0.204		
T1 Parent EC	-0.166		
Time 1 teacher-reported physical aggression		R^2 = 0.245, Adjusted R^2 = 0.107, F (4, 22) = 1.783, p = 0.168	
Step 1			R^2 = 0.192, Adjusted R^2 = 0.087, F (3, 23) = 1.824, p = 0.171
T1 Parent Inhibit	0.063		
T1 Parent Shift	0.204		
T1 Parent EC	-0.166		
Step 2			R^2-*Change* = 0.053, *F-Change* (1, 22) = 1.532, p = 0.229
T1 Attachment	0.412		

Note: All significant ($p < 0.05$) values are in bold

Appendix L (con't)

Predictor Variables	F-Test of Overall Model	F-Test of Regression Model (Steps)
Time 2 parent-reported physical aggression	R^2 = 0.409, Adjusted R^2 = 0.269, F (4, 17) = 2.936, p = 0.052	
Step 1 T2 Attachment		**R^2 = 0.194, Adjusted R^2 = 0.154 F (1, 20) = 4.828, p = 0.040**
Step 2 T2 Parent Inhibit T2 Parent Shift T2 Parent EC		R^2-*Change* = 0.214, *F-Change* (3, 17) = 2.051, p = 0.145
Time 1 parent-reported physical aggression	R^2 = 0.409, Adjusted R^2 = 0.269, F (4, 17) = 2.936, p = 0.052	
Step 1 T2 Parent Inhibit T2 Parent Shift T2 Parent EC		**R^2 = 0.394, Adjusted R^2 = 0.293, F (3, 18) = 3.897, p = 0.026**
Step 2 T2 Attachment		R^2-*Change* = 0.015, *F-Change* (1, 17) = 0.425, p = 0.523

Note: All significant ($p < 0.05$) values are in bold

Appendix M:

Study 2 Correlations Between Attachment and Parenting Styles

Bivariate Zero-Order Two-Tailed Correlations Between Attachment and Parenting Styles in Study 2 (Time 1 and Time 2)

Measure	T1 Authoritarian Parenting	T1 Permissive Parenting	T1 Authoritative Parenting	T2 Authoritarian Parenting	T2 Permissive Parenting	T2 Authoritative Parenting
T1 KCAQ Attachment	**0.451****	**0.495****	**-0.462****			
T2 KCAQ Attachment				**0.756****	**0.747****	**-0.798****
Mean	16.364	8.636	56.542	16.352	9.904	56.915
SD	4.498	3.331	6.821	5.647	3.267	6.424
N	47	47	41	23	23	22